SCIENTIFIC AMERICAN

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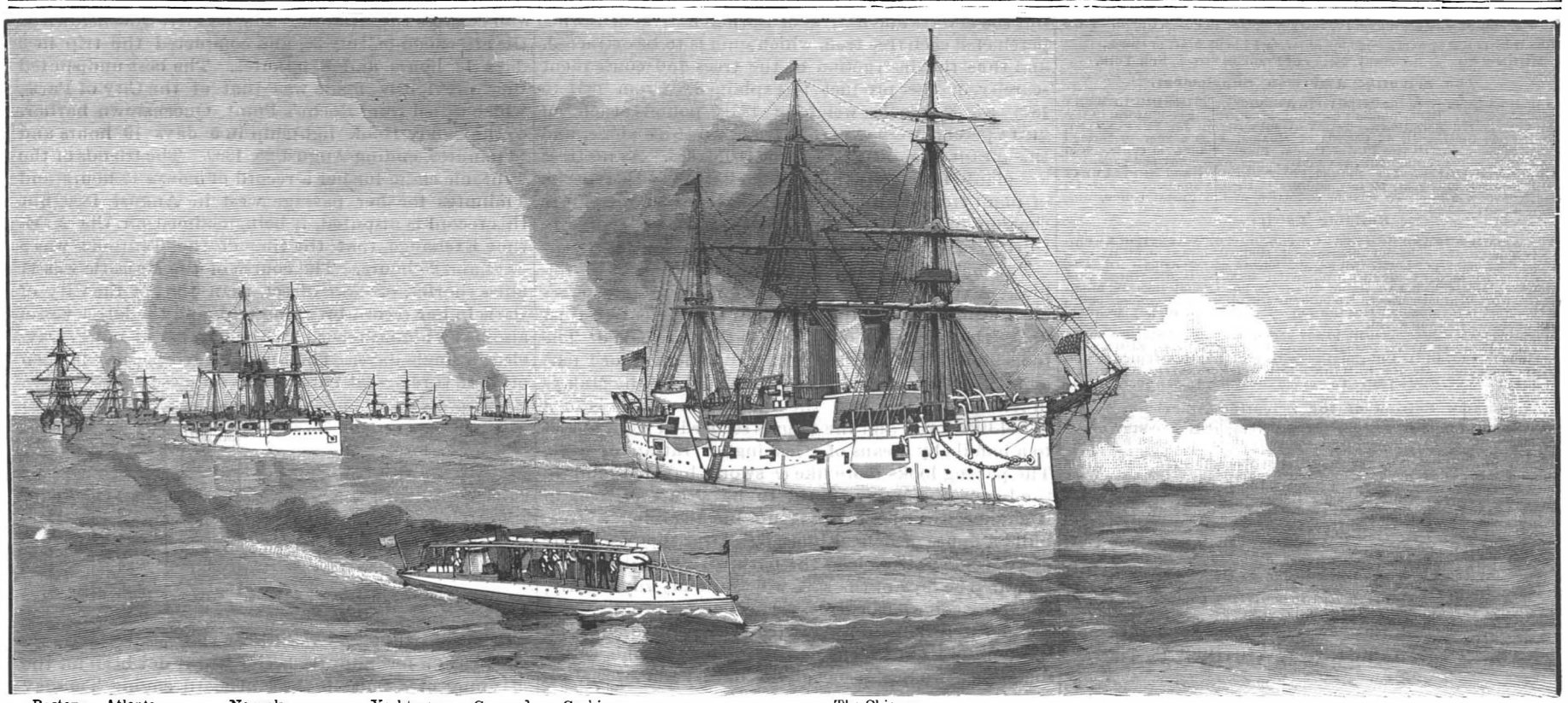

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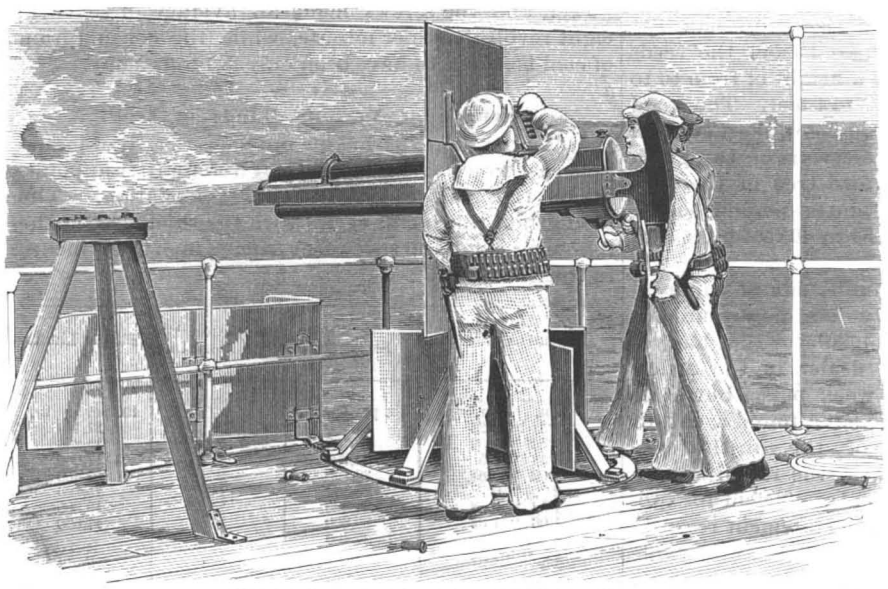

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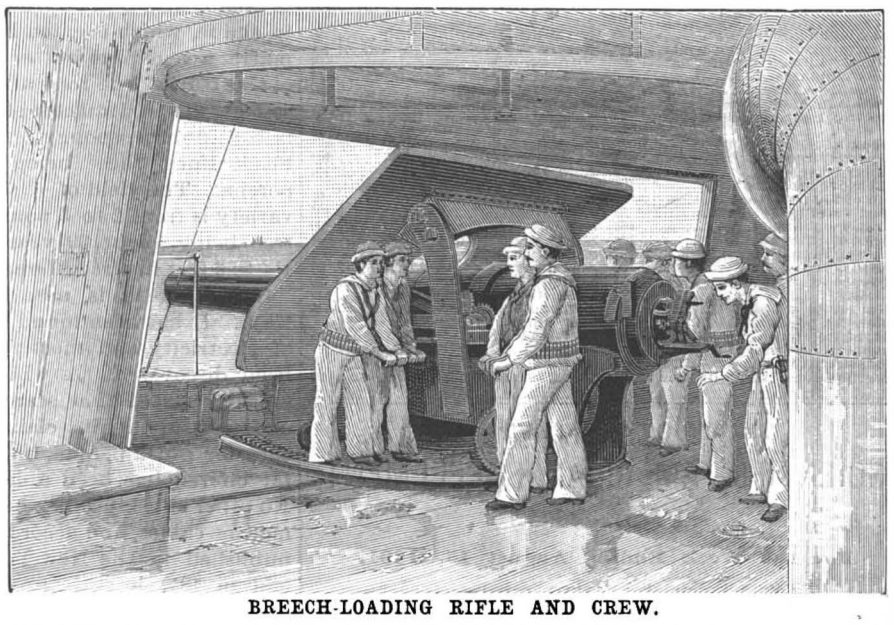

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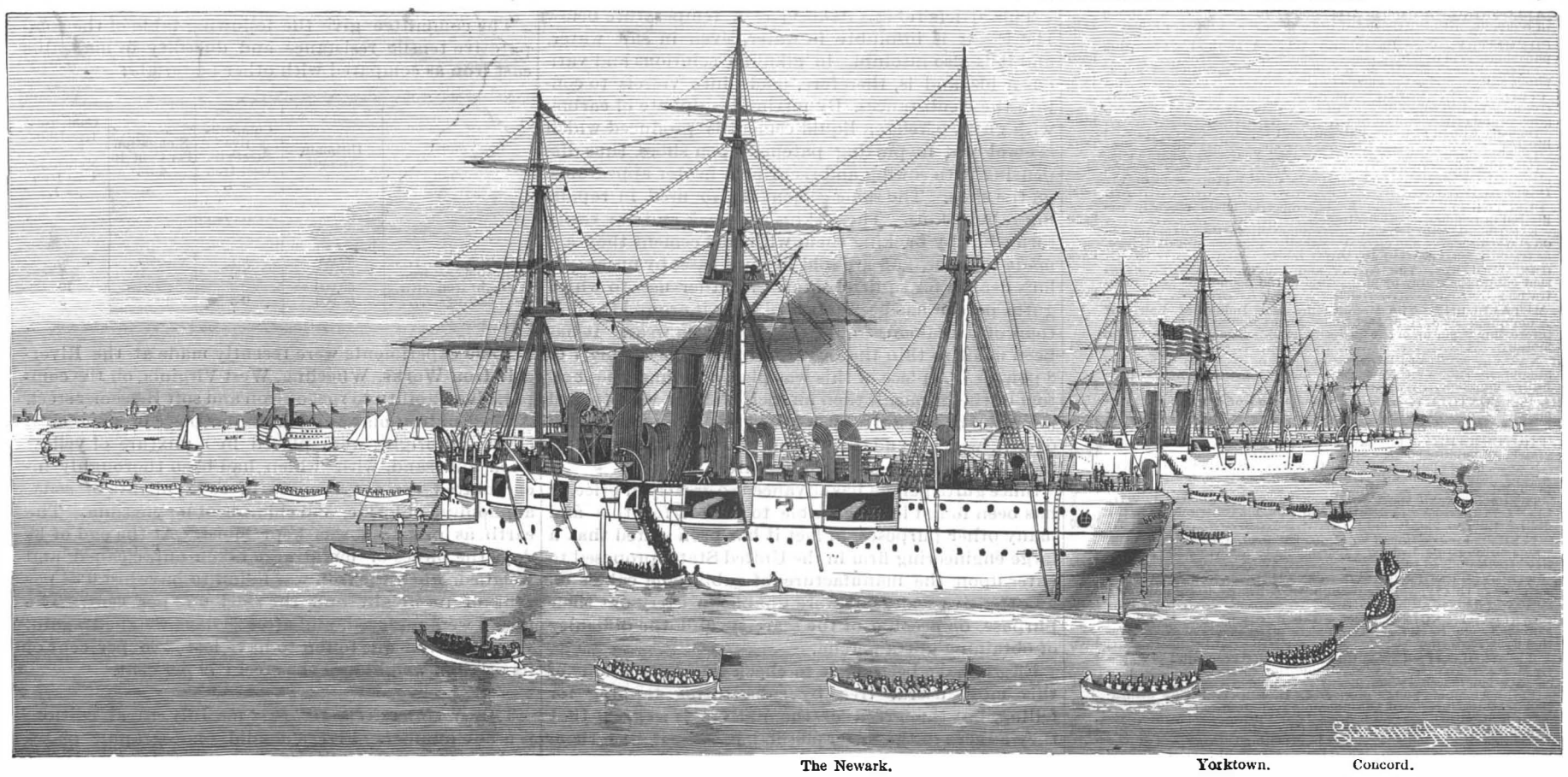

The Newark. Yorktown. Concord.

EVOLUTIONS OF THE U. S. SQUADRON AND DRILL OF THE NEW YORK STATE NAVAL RESERVE.—THE ATTACK ON FISHER'S ISLAND.—[See page 101.]

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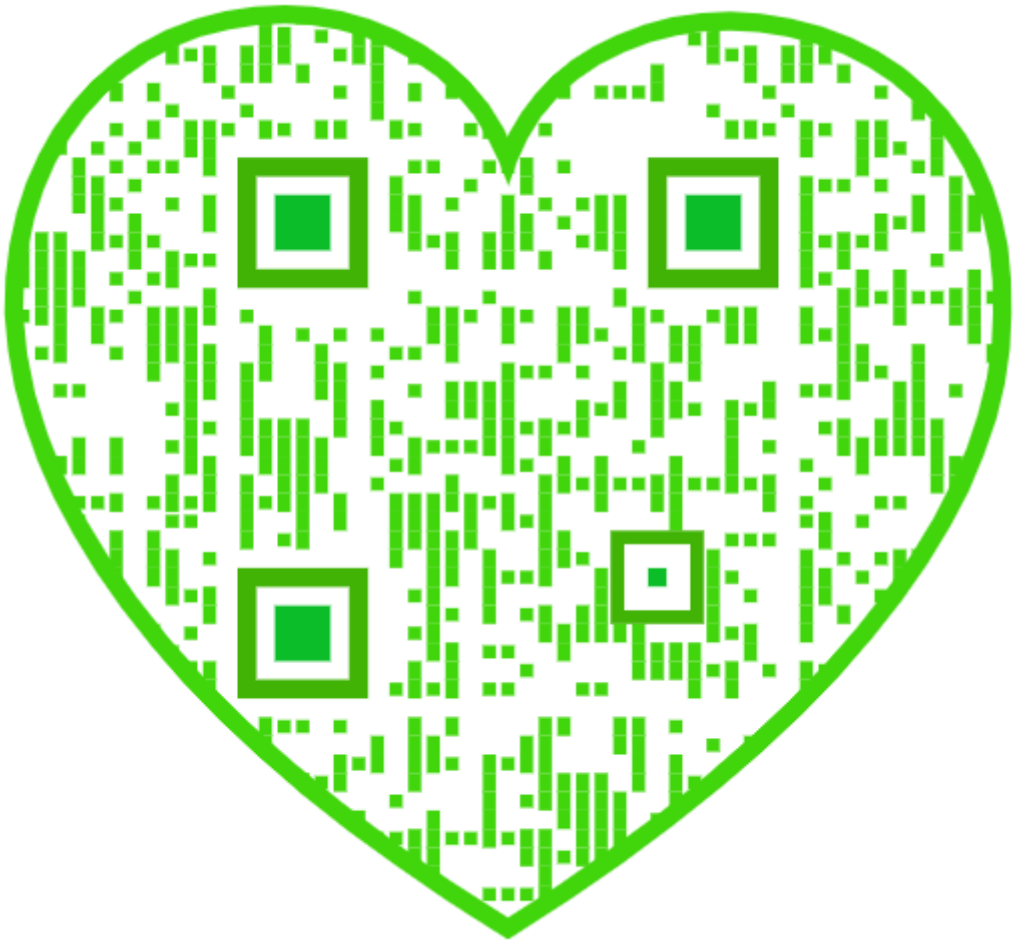

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NEW YORK, SATURDAY, AUGUST 15, 1891.

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GUTTA PERCHA.

The price of gutta percha has nearly doubled in two years, and now rules at $1.30 per pound. This remarkable advance in the price of the article is attributed to two causes—the large quantities required in the manufacture of electric and other modern devices and the reckless destruction of the trees from which the gum is obtained. Gutta is the Malayan term for gum and percha is the name of the tree from which it is obtained; therefore the name may be translated, gum of the percha tree. This gum or sap is not obtained by merely tapping the trees, as is done by the gatherers of crude rubber along the Amazon and its tributaries, but the Malays and natives of Borneo who collect gutta percha fell each tree from which gum is to be extracted, and thus the destruction of the trees and consequent scarcity of the product is explained. From 1854 to 1875, 90,000 piculs, weighing 133⅓ pounds each, of gutta percha were exported from Sarawak alone, and this meant the death of 3,000,000 trees. As no trees are planted, the only thing which has saved this species of plant from annihilation is that it does not produce the gum in paying quantities until it is twenty-five to thirty years old.

The method pursued in felling the trees is as follows: A staging is erected from fourteen to sixteen feet high, which enables the workman to cut the trees just above the buttresses or banees as they are called. The tools used in felling are either "billiongs" or "parangs." A billiong is a kind of ax used by the Malays in felling, building and the like. The blade is of a chisel-like form, and the tang is secured at right angles to a handle by means of a lashing of rattan or cane. The parang looks more like a sword bayonet, and in the hands of a Malay is said to be a box of tools in itself, as with it he can cut up his food, fell a tree, build a house or defend himself. After the tree is cut down, some natives beat the bark with mallets to accelerate the flow of the sap, which usually runs slowly, changing color meanwhile. It concretes rapidly.

The sap is boiled either with water, lime juice, or cocoa nut oil, and it is generally run into moulds which sometimes produce forms of the hardened material resembling various animals in shape.

The gutta percha tree, the vernacular name of which is taban, also bears a fruit about an inch long, ovoid in shape, which is eaten by the natives. In Siak, Sumatra, a vegetable butter is prepared from the seeds of this fruit. The trees attain to a height of from 60 to 80 feet, with a diameter of from 2 to 4 feet. The wood is soft, fibrous, spongy, of a pale color, marked with black lines, these being the reservoirs of the gutta percha. The yield of a well grown tree of the best variety is from 2 to 3 pounds of gutta percha, such a tree being about 30 years old, 30 to 40 feet high, and 1½ to 3 feet in circumference.

Gutta percha is used in a multitude of different ways. It has been found to be the best non-conductor of electricity and most perfect insulator that has yet been discovered. A wholesale dealer in the article recently stated that scarcely a week passes but some one calls upon him claiming to have found a substitute for gutta percha, but none of the substitutes so far offered has been able to meet the requirements. No other substance has been found so efficient for submarine cables, and according to a statement recently published in the New York *Sun*, the Atlantic cable laid in 1857 is still preserved by its gutta percha covering.

This article retains its form at a temperature below 115° F. It is insoluble in water, even in salt water, and it is also insoluble in alkaline solutions and various acids, and is, therefore, made into vessels to contain these substances. By mixing bisulphate of carbon with gutta percha, a liquid cement is produced which is employed in putting patches upon shoes, thus dispensing with sewing and securing a neater appearance on the shoe. The same cement is also used in repairing rabbit skins. These skins are weak and are easily torn; but by backing them with this cement they are made tougher, and are sold in some cases by unscrupulous dealers for squirrel skins. Another use to which gutta percha has been put is placing it around the bottoms of pantaloons to protect them from wear. It has been made so thin that a yard of it weighed only 7 to 8 pounds. A piece of this was placed around the bottom of the garment, then an inch of cloth was turned in on top of the gutta percha, a hot iron was passed over it, which rendered it secure, thus saving the expense of sewing to the manufacturer.

Since gutta percha has advanced so greatly in price, it has been found impracticable to use it for this and many other purposes, in fact it has been stated that a large engineering firm in the United States proposed to enter upon the manufacture of submarine cables on an extensive scale, but were unable to carry out their purpose, on account of the scarcity and the difficulty of obtaining gutta percha.

Efforts have been made to check the destruction of this most useful tree by substituting tapping for felling, but the greed of the natives is so great that they adhere to the latter method, because it gives them more of the sap for immediate marketing, being regardless of the fact that the trees are being exterminated. The only remedy for the great scarcity of the article seems to be the cultivation of the tree, and measures of this kind will have to be adopted if gutta percha, which seems to be an article entirely indispensable in some lines of manufacture, retains its place in the commerce of the world.

The Atlantic Record again Lowered.

At 2:30 in the morning, August 5, the White Star steamer Majestic arrived at Sandy Hook lightship, at the entrance of New York harbor, breaking all previous records and achieving the quickest voyage ever made across the Atlantic. She had left Queenstown in the afternoon of July 30, and completed the trip in 5 days 18 hours and 8 minutes. The best undisputed time previously made was that of the City of Paris, which sailed from Roche's Point, Queenstown harbor, to the Sandy Hook lightship in 5 days 19 hours and 18 minutes, ending August 28, 1889. The friends of the Teutonic claim for her a record of 5 days 19 hours and 5 minutes for her passage west in August, 1890, but this record is disputed, it being claimed on the Maritime Exchange that the time of the Teutonic was 5 days and 20 hours. The course of the Majestic was 11 miles shorter, or more direct, than that of the City of Paris in her record breaking trip, and the latter vessel also has a higher record for the number of miles traveled in single days. The knots logged per day in each of these three great trips was as follows:

	Majestic.	City of Paris.	Teutonic (Disp'd.)
First day	470	432	473
Second day	501	493	496
Third day	497	502	512
Fourth day	501	506	500
Fifth day	491	509	485
Sixth day	317	346	340
Total	2,777	2,788	2,806

It is said that the record of the Majestic would have been a few minutes better had it not been for the snapping of a bolt in the starboard engine Tuesday morning, so that for one hour only the port engine was running. The two engines developed 19,500 horse power, and the screws made an average of seventy-eight revolutions per minute, while the consumption of coal is stated to have been only 220 tons a day.

Strength of Various Kinds of Iron.

A number of experiments on the strength of malleable cast iron have been made by a committee appointed by the Master Car Builders' Association. The strength of this metal varies with the thickness, as the following results on specimens from ¼ inch to 1½ inches in thickness show:

Dimensions.	Tensile Strength.	Elongation Per Cent on 4 in.	Elastic Limit.
in. in.	lb. per sq. in.		lb. per sq. in.
1·52 by 0·25	34,700	2	21,100
1·52 " 0·39	33,700	2	15,200
1·53 " 0·5	32,800	2	17,000
1·53 " 0·64	32,100	2	19,400
2 " 0·78	25,100	1½	15,400
1·54 " 0·88	33,600	1½	19,300
1·06 " 1·02	30,600	1	17,600
1·28 " 1·3	27,400	1	
1·52 " 1·54	28,200	1½	

The low ductility of the metal is worthy of notice.

The committee give the following table of the comparative tensile resistance and ductility of malleable cast iron as compared with other materials:

	Ultimate Strength.	Comparative Strength. Cast Iron = 1.	Elongation Per Cent in 4 in.	Comparative Ductility. Malleable Cast Iron = 1.
	lb. per sq. in.			
Cast iron	20.000	0·1	0·35	
Malleable cast iron	32,000	1·6	2	1
Wrought iron	50,000	2·5	20	10
Steel castings	60,000	0·3	10	5

Some experiments were recently made at the Riverside Iron Works, Wheeling, West Virginia, on the comparative liability to rust of iron and soft Bessemer steel. A piece of iron plate and a similar piece of steel, both clean and bright, were placed in a mixture of yellow loam and sand, with which had been thoroughly incorporated some carbonate of soda, nitrate of soda, ammonium chloride, and chloride of magnesium. The earth as prepared was kept moist. At the end of 33 days the pieces of metal were taken out, cleaned, and weighed, when the iron was found to have lost 0·84 per cent of its weight and the steel 0·72 per cent. The pieces were replaced, and after 28 days weighed again, when the iron was found to have lost 2·06 per cent of its original weight and the steel 1·79 per cent.

THE *Northwestern Architect* for July, royal edition, is a fine number. Five splendid photographic plates and numerous other illustrations adorn the issue.

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Nitro-Cellulose.

BY DR. J. B. LITTLEWOOD.

Gun-cotton is obtained by the action of nitric acid, in the presence of sulphuric acid, upon the purest cellulose—cotton fiber—and is a substitution product. According to the treatment followed—the strength of the acids, etc.—are obtained mono-, di-, tri-, tetra-, penta- and hexa-nitro compounds. These are termed soluble and insoluble, according to their solubility in alcoholic ether. The equation illustrating the reaction has been written for tri-nitro-cellulose :

Cotton. Nit. Acid. Gun-cotton. Water.

$$C_6 H_{10} O_5 - 3HNO_3 = C_6 H_7 (NO_2)_3 O_5 - 3H_2O$$

A number of these substitution products are known; the soluble varieties being used for collodion ; the insoluble as explosive agents, generally the tri-nitro.

The process consists essentially in exposing the dried cotton for a sufficient length of time to the action of a mixture of nitric acid (sp. gr. 1·45 to 1·50) with sulphuric acid (1·84 to 1·85), and in then thoroughly washing the fiber to remove all free acid adhering thereto.

The fiber has been submitted in all forms, from the carded mass or hank to the finest impalpable powder. This powder has been obtained by both chemical and mechanical means—by cuprammonium and by grinding. The reasons for comminution of the cotton are that when the cotton is subjected to the action of the acids in its natural state and length of fiber, the line of least resistance seems to be by way of the inside of the tubes constituting the fiber of the cotton, into which they are taken in part by capillary attraction, subject to change themselves as they progress, and to increased resistance from any oil or gum, etc., in their progress, and therefore to modified action, the result of which is slower and slower, and otherwise more and more imperfect chemical change. It may also be that the power of capillary attraction is balanced in the tubes by air contained therein sufficiently to prevent the acids from taking effect.

It has also been customary to wash the cotton in alkaline baths, rinse and dry before steeping in the acids mixture, and whatever alkali was not neutralized would effect the nitration.

The cotton fiber has for its protection a glazed surface, as if it were enameled by nature. It is tubular and cellular in structure, and contains a natural lubricating semi-fluid substance, composed of characteristic oil or gum, or water, or other material, or a combination thereof. Both the glaze and the lubricating substance as well as the fineness of the fiber vary with the soil, climate and other accidents of growth. Where cotton waste is obtainable, this is cleansed for the purpose of conversion, and, unless carefully treated, there is liability of variable nitration of material thus obtained. Where yarns and hanks are employed it has been found that the twisting of the fiber and the disposition in the yarn form caused a resistance to the penetration and to the action of the acids, with the result that parts of the fibers were not acted upon, or acted upon imperfectly.

The same difficulty has been observed where paper has been expressly prepared from cotton fiber for conversion. In this last case the fiber is, of course, modified by the chemical and mechanical treatment which it has undergone in the preliminary preparation of the paper; but, if the adherent oil or gum or glaze has been attacked, or if all have been removed by subsequent washing, etc., which is very difficult, if not impossible, the character itself seems to have been altered to such an extent that the cellulose product of the paper process is not uniform, or always otherwise satisfactory.

The proportions of acids used vary from one of nitric with three of sulphuric to one to two (as at Le Bouchet). Abel's method (British) and that in use at Newport are alike in using one to three. At the torpedo station either raw or carded cotton is used. It is first steeped in a weak solution of carbonate of soda, to remove the resin from the raw cotton, or the oil from the carded, then washed and carefully dried. The acids are the strongest nitric and sulphuric. A large quantity of the mixed acids is placed in the leaden pan and into this a small quantity of the dried cotton is immersed. When thoroughly saturated, the cotton is lifted upon a reticulated shelf over the pan to drain. It is then pressed, placed in an earthen jar, and, when this is half full of the dipped cotton, fresh acid is poured upon it until the cotton is covered. It is then set where the temperature may be kept reduced for 48 hours. The greater part of the conversion takes place at the dipping, but that it may be complete it is necessary that the contact with the acids should continue for the time stated. When the cotton is removed from the first bath, a quantity of fresh acid equal to that removed with the cotton is added before a fresh batch is treated.

At the end of the time stated the cotton from the jars is passed through rubber or leaden wringers.

Where equal parts of the concentrated acids were used, the acids from the first batch were used once again, the time of immersion being extended. In other cases the spent acids are restored in bulk by the addition of a suitable quantity of a nitrate and sulphuric acid, thus employing the acidulous mixture continuously in the conversion of successive batches of material. In this case, by using a nitrate the base of which forms, when introduced into the bath, an insoluble compound, the bath becomes clarified by subsidence of the precipitant. In other cases the spent acid is treated to free it from flocculent matter, after which it is restored by means of fresh acids, and so utilized. The proportions of cotton to acid vary from 1 to 6 up to larger baths. At Waltham Abbey the cotton in 1 lb. quantities is dipped into a 12 gallon pan of the mixed acids.

The same acids have been used again for treatment of successive batches without strengthening, except the addition of such a quantity of acid as may be required to properly cover the fiber. Again, the spent acid has been analyzed to ascertain its condition, and an amount of fresh acids mixed therewith sufficient to restore it for use. Spent acids are in some cases used for the first dipping, followed by a bath of the concentrated acid in usual proportions to fully complete the nitration. Nitration has also been effected by addition of a part only of the acid required for conversion; allowing reaction, and passing the material into additional quantity of the acid required to complete. It has also been effected by immersion of the cotton in a series of tanks, beginning with that having the weakest acid, and following until the fiber has been fully nitrated. As soon as the acid of the first vat falls below the required strength it is replaced by fresh, full-strength acid. This is operated by having the vats on a turn-table, passing the acids pressed out back to the vat from which they were taken. In this way all the suitable properties of the acid are utilized, the weakest acids becoming weaker by the partial conversion of the cotton which they effect, while the last immersions of each charge of cotton are in the strongest acid. This latter plan was to render available all the valuable properties of the acids, and enable the use of such acids until they have become entirely spent, in lieu of the usual way of treating the cotton by repeated immersion in the same acids, or by successive immersions in different receptacles, where the weakened but not entirely spent acid is thrown away.

Earlier, the spent acids were used only for the manufacture of the weaker kinds of powder, to economize the cost of manufacture.

Fiber has been treated with sulphuric acid prior to nitration, and in this way the material has the character of vegetable parchment imparted to it before it is subjected to the bath of mixed acids. The fiber is washed and dried in this case before nitration.

Where wood is used as the form of cellulose it is necessary to comminute or disintegrate it, and by boiling in presence of alkali under pressure to remove sap, resin, and salts ; then washing in a poacher with pure water ; beating, straining, and drying. This fibrous pulp is submitted to the usual bath of nitric acid at 1·40 to 1·50 (one part) with sulphuric acid at 1·80 to 1·84 (two parts). The fiber is kept in this bath of cooled acids twenty-four to thirty hours, with occasional agitation, squeezed, and thoroughly washed, steeped in alkali ; again washed and dried.

The washing is performed at Newport by repeated passage through a wringer, which is so mounted that the water pressed out is led away, the squeezed gun-cotton falling into fresh water, and in this way a more thorough purification is obtained, in a shorter time, than by the ordinary method of very long exposure to the action of running water.

The Abel method of washing included the use of a pulping engine or beater, where the fiber was submitted to a revolving wheel carrying projections which passed between stationary projections on the bottom of the tub, and thus became fully torn, and from this beater the pulp passed to a washer (poacher), where the pulp was stirred for a long time with large quantities of water. The revolution of the wheel in this tub prevented deposit in any part of the tub.

At Stowmarket an artificial cascade is made by leading a stream of water along a trough, and allowing it to fall from a height into the washer. The gun-cotton is thrown on the falling stream and immediateiy carried deep down into the vessel, the agitation being further promoted by the workmen. In this way the cotton comes in contact with such a large quantity of water that the rise in temperature is inappreciable, and the pyroxyline almost altogether free from acids. But, to perfect the washing, the pyroxyline is passed through the centrifugal machine and then thrown into tanks, where it is subjected to the action of water for one to three weeks, and is afterward boiled in large vats below 212° F. These washings may be followed by the addition, or use in them, of alkaline material.

Oxidants may be added to the fiber before drying, and it may be pressed into the form of slabs, cylinders, or pellets.

Unmixed with salts, it may be stored in this wet condition, and is then the safest of all explosive agents. It is not liable to be fired by a spark or flame, nor is affected by blows, friction, or other rough handling. The only care necessary is that the cakes be not frozen.

The Divining Rod.

From the large number of inquiries about divining rods and their efficacy, we infer it to be a subject which interests a great many persons. The latest account on this mystic subject comes from Australia. Mr. William Spiers, M.A., F.C.S., F.R.M.S., writes to the *Mining Standard*, "Probably most of your readers have heard of the 'divining rod,' and have concluded that it was either a myth or that its effects were the results of evil agency. The reports that by its means subterranean watercourses or buried minerals have been discovered are generally rejected as mere rumors, or as instances of self-deception or even fraud. I confess I have myself been quite a skeptic in regard to the matter, but I have now what I consider good reasons for recanting. Being recently in the company of a few geologists on the Yorkshire Wolds, it was stated that one of our company was able to discover hidden water or metals by means of the magic rod. Our friend cut out of the hedgerow a fork of hawthorn shaped like a long V. Holding a prong in each hand, with the apex downward, we soon had an opportunity of seeing that 'there was something in it.' Here and there as he slowly walked along, the apex of the branch curled upward as if alive. I knew the gentleman too well to suspect that he was cheating us, but, in order to see that he was not self-deceived, I placed my hand around the muscles which must have moved had the contortions of the rod been due to unconscious muscular contractions. I quite satisfied myself upon that point.

"I then requested him to close his eyes, and I led him over a small rivulet that was running down the hill on which we were walking, and the moment he reached it the rod commenced its remarkable movements. As soon as I touched it with my fingers it resumed its natural position. For water it moved away from him, but for metals it swung round in the opposite direction. To test this a botanical case made of galvanized iron was brought near our necromancer, and the rod at once flew up. Our friend related many discoveries that he has made during the last 20 years. Generally he used hazel. Copper wire shows the same peculiarities, and this we were able to see at the time. When standing on a non-conductor, such as broken china, the effects were not produced. Our comrade is a student of science, and has not sought to make money by his gift, and this, of course, makes it impossible to doubt his integrity.

"He has plans of wells that have been sunk in various places as the result of his indications, and in one instance he was instrumental in discovering a disused and forgotten gas main. As he found out quite accidentally that he possessed this faculty, it may be that some of your readers may make a similar discovery in regard to themselves, and, as Abraham Cowley puts it, may amuse themselves by searching 'with fond divining rods among the dead for treasures buried.'"

The American Institute Fair.

The interest of the public in industrial and commercial exhibitions generally will undoubtedly be greatly stimulated this year by the extensive preparations almost everywhere being made for the World's Columbian Exhibition at Chicago. Among the various attractions of this kind offered to the public, and presenting valuable opportunities to inventors and artisans ready to invite attention to their work, perhaps there are none which have a longer or more useful record than the annual fairs of the American Institute, New York City. The Sixtieth Exhibition of the Institute will open this year, September 30, and close November 28, giving two months' time to exhibitors improving the full period. The General Superintendent, Mr. Charles Wager Hull, is ready at the offices of the Institute, No. 113 West 38th Street, to give information and receive applications for space. The fair will be held in the Exhibition Hall on Third Avenue, and the building will be open for the reception of machinery on September 14th, and for other exhibits on September 21st. The early applicants for space will have the advantage of position, and the entries for the forthcoming exhibition already show a continued interest in the American Institute.

Novel Heat Motor.

Mr. Shelford Bidwell's heat engine depends for its action upon the fact that nickel is magnetic at ordinary temperatures, but at 300° C. becomes suddenly non-magnetic. A slip of nickel is attached to a disk of copper suspended by two strings, so that it can swing like a pendulum. On one side of the hanging metals is a magnet, with which the piece of nickel is ordinarily kept in contact, and held by it. By placing a gas flame or a spirit lamp underneath the nickel, so as to warm it, it becomes so heated as to lose its magnetism, or power of being magnetized, and falls off—the pendulum thus making a swing. By its passage through the air, the nickel is cooled below the critical point, and on returning is held again by the magnet, only to fall off again as before, and so on, with considerable regularity, so long as the source of heat is kept up.

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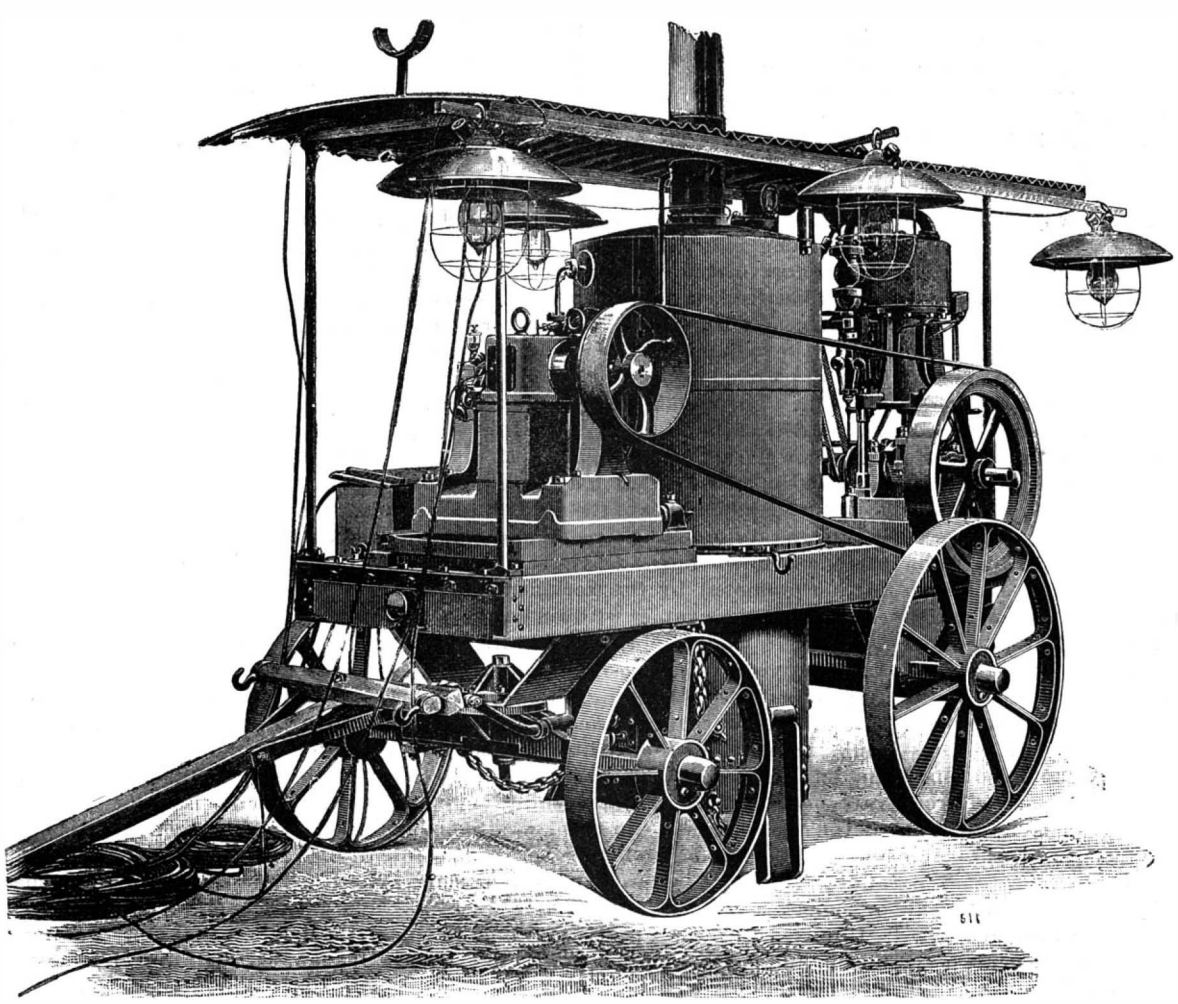
Troublesome Building Foundations.

There has been so much discussion of the merits of obtaining a foundation for high buildings on the treacherous soil of Chicago that it may not be amiss to give a summary of the views of the two architects that seem to be the especial champions of opposite systems. The Chicago *Herald* boils the long letter by Mr. Dankmar Adler, recently published in the *Economist*, to the following: "He claims at the outset that the present methods employed in the foundations of tall buildings, however ingenious they may be, are insufficient for the ultimate development of the requirements of tallest business buildings. He then cites the grain elevators, which are subjected to very great pressure and variation of pressure, and are also usually built upon treacherous soil. These stand upon pile foundations. This simple fact seems to have escaped notice. The theory of the isolated pier construction seems justifiable, because a careful computation of weight to be sustained and careful workmanship have made it possible to secure so slight settlement and deviation that architects have lost sight of the desirability of securing the nearest approximation to an unyielding structure. The Cook County court house, which is built on piles, the Chicago city hall and the United States government building, which are built on concrete, are cited. These buildings have created a prejudice against pile and also against monolithic foundation; but the trouble was not with the theory upon which they were built, but with the execution. They were constructed wrongly and unintelligently. Then came Frederick Baumann's admirable treatise in favor of the theory and practice of the system of isolated pier construction as applied to the erection of tall buildings on compressed soil. Gradual improvements, moreover, came upon this isolated pier theory, such as the use of the cantilever system. Now at last comes the reintroduction in the construction of high buildings of the long neglected and undervalued system of pile construction. The Northern Pacific station on Harrison Street is built successfully on piles. The German theater upon Randolph Street is to be built on piles. In digging upon this latter site the characteristic soft Chicago mud was found to a depth of from forty-two to forty-eight feet below the cellar floor. Then was found hard tunnel clay. Fifty-foot piles have been driven in till the points penetrated securely this clay. The heads of the piles have been cut off three feet below the sewer level or water line, and are covered with a grillage of oak timbers. Upon this is formed a foundation of concrete and I beams, the out part of which act as cantilevers. Thus is formed an unyielding substructure for the foundations. The pile construction is conceived to be as well constructed as, and to be loaded no more heavily than, the foundation used successfully under the Northern Pacific depot."—*Northwestern Architect.*

PORTABLE ELECTRIC LIGHTING PLANT.

We illustrate a portable electric light plant constructed by Hayward Tyler & Co., London, for a large dock company. It is mounted upon a frame carried by four wrought iron traveling wheels, and is fitted with a pole for two bullocks. The boiler stands in the center, the engine being at one end and the dynamo at the other. The boiler is 6 ft. 6 in. high by 2 ft. 9 in. in diameter. The firebox is crossed by two tubes 8 in. in diameter. The engine has a cylinder 5 in. in diameter by 6 in. stroke, and is of the inverted type with Pickering governor. By means of a belt it drives the dynamo. This is compound wound to give 20 amperes of current at a pressure of 10 volts, when running at 650 revolutions per minute. It supplies four incandescent lamps of 200 candle power each. Each lamp is provided with a strong enameled iron reflector fitted with a wire guard, and a length of twin flexible cable. A plant of this description will be very useful in many kinds of outdoor work.—*Engineering.*

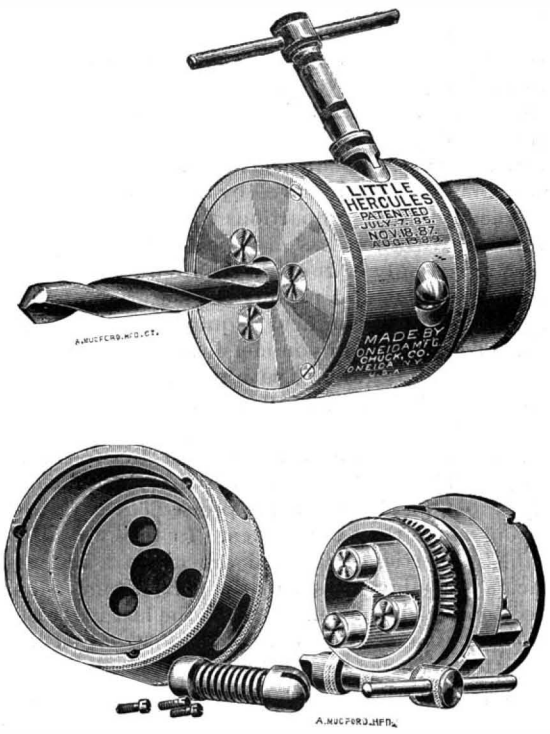


IMPROVED PORTABLE ELECTRIC LIGHTING PLANT.

BY the use of a new machine, potatoes may be planted in a straight line and with the hills at equal distances apart.

AN IMPROVED CHUCK.

The drill chuck shown in the illustration has been recently placed upon the market by the Oneida Mfg. Chuck Co., Oneida, N. Y. It is simple and durable in construction, very powerful and accurate. The holding shell includes body face plate and connecting screws, and the working parts are composed of three jaws, an engaging ring and an actuating screw, all inclosed within the body. The jaws are pivoted at their ends and rotate eccentrically, offering an unbroken tool bearing of their whole length, which affords entire



THE LITTLE HERCULES DRILL CHUCK.

immunity to the drill shank. The jaw faces are curved backward at such an angle from their axes and lever arm that the resistance of the work upon them produces a self-gripping of the jaws, which in turn reduces the work of the actuating screw nominally to that of a follower or holder. In using tools of the largest size of hold the tool is acted upon by the jaw very nearly opposite the pivot or fulcrum. This gives the longest possible leverage, and the greatest power upon the largest tools. The smaller the tool the nearer the contact comes to the joint of the jaw. The chuck thus becomes a self-poised tool, acting upon all sizes of tools with a relative power equal to the resistance offered, a point in which it is claimed this chuck is greatly superior to all others. The little Hercules is placed in the market only as a high grade tool, with perfect stock and workmanship, all its parts in duplicate.

A New Theory of La Grippe.

The unaccountable nature of the influenza commonly known as the grippe has invited the theories of all sorts and conditions of men, not to say of doctors, but among all no one is, perhaps, so well calculated to commend itself to confidence as that of Sir Morell Mackenzie, M.D., who in a paper in the June *Fortnightly* asserts that in his opinion "the riddle of influenza is poisoned nerves," and from this hypothesis "the bewildering diversity of symptoms becomes intelligible, if we regard them as the results of disordered nervous action." Dr. Mackenzie compares it to the extraordinary disturbance in telegraphic systems produced by a thunderstorm, and says this is nothing "compared with the freaks played by the living conductors in the human body, if anything throws the governing centers out of gear."

Now the theory of "poisoned nerves" is one that explains the almost infinite variety of attacks and curious freaks that mark the disease. No two persons, it is safe to say, have ever experienced precisely the same symptoms, and if it is a nervous disturbance, this is the natural result. Dr. Mackenzie regards the epidemic as falling under three general types, each of which include many varieties; these are the catarrhal, the digestive, and the nervous. "Influenza," he says, "is the very Proteus of diseases, a malady which assumes so many forms that it seems to be not one, but an epitome of all diseases, and its symptomology includes almost everything, from a cold in the head to inflammation of the brain. . . . It is really an acute specific fever, running a definite course like measles or scarlatina. . . . It is a disease with that superficial complexity of aspect which made Mrs. Carlyle playfully suggest that the doctors had agreed to call half a dozen different diseases by one name in order to simplify treatment."

Dr. Mackenzie adds that under all its disguises, he believes the disease to be perfectly simple; that the profound impression made on the nervous system by the poison explains nearly all the after effects of the malady, and especially that curious loss of vital energy which is so disproportionately great in comparison with the disease itself. The cause Dr. Mackenzie believes to be a living germ, air borne, but of what nature is not yet, he believes, established.

Steamer Empress of China.

The Empress of China, the last of the three vessels contracted for by the Canadian Pacific Railway with the Naval Construction and Armaments Company, Limited, of Barrow, went lately on trial from the Clyde to Conningberg, and thence to the Mersey. She is intended for the Pacific trade, and is an exact copy of both the preceding steamers. The trial was a complete success, some 600 horse power being developed over the sister ships. On the measured mile a speed of 19 knots was attained, while on the sea trial, in the face of a strong gale and heavy sea, the vessel ran 16·6 knots, and this was considered by both builders and owners as very satisfactory. The following are the dimensions of the steamer: Length over all, 485 feet; length between perpendiculars, 440 feet; beam moulded, 51 feet; depth, 36 feet; height from top of keel to upper deck beam, 39·10 feet. The gross tonnage is 5,920, and the total deadweight capacity, with a mean draught of 24·6, is 4,000 tons. The vessel is divided into fifteen watertight compartments.

The Empress of China, as well as her two sister ships, all first class and highest speed, has been built to share in the large subsidy given by the British and Canadian governments to promote trade and maintain British naval supremacy.

TO make skeleton leaves, soak in rain water for some weeks, remove by floating upon a card, and very gently remove upper skin with a soft camel's hair brush. Float in water and catch on a card with the other side uppermost, and remove other skin and pulp. A stiff brush may be needed, to be used by dabbing. Do not touch with finger. Finally wash well, bleach with javelle water, wash and dry.

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Deterioration of Water in Reservoirs and Conduits.

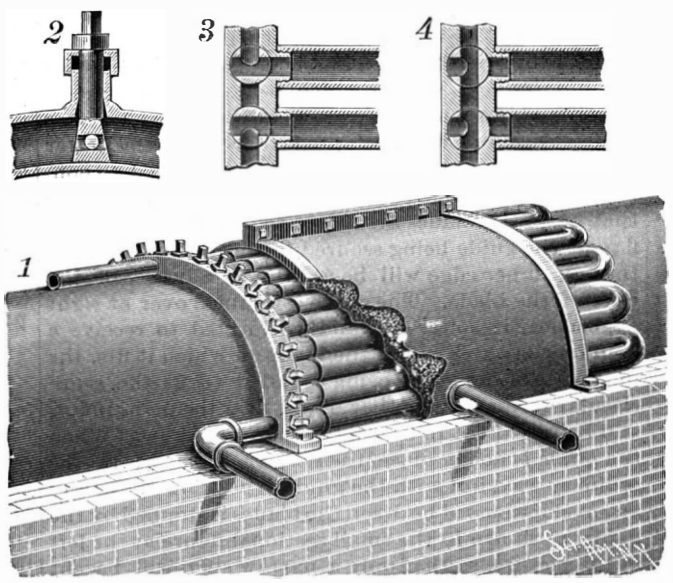
Some time ago at a meeting of the New Jersey Sanitary Association, Mr. C. B. Brush dealt with the above subject in a paper. He remarked that all water supplies are better at certain periods of the year than at others. In the hot, dry days the water becomes dead and lifeless, and if allowed to remain at rest for any considerable length of time, algæ formations appear on the surface. These, however, are destroyed and disappear as soon as the water is put in motion. If allowed to remain, the water cures itself—the algæ disappearing after a few weeks and leaving the water again in its normal condition. The algæ show themselves more quickly on water that has been filtered, either naturally or artificially. The author also stated that water is delivered in its best condition when taken from a running stream and supplied directly to consumers without coming to rest during its passage. Water discolored by sediment is very often in its best condition, because the sediment is due to the fact that an abnormal volume of water is blown off from the watersheds, and any pollution there may be is so diluted as to be incapable of harm. But there is such a demand for clear water that reservoirs are necessitated, with their attending evils. Water that is stored for twenty or thirty days commences to deteriorate. This is due to stagnation, and the stagnation begins to manifest itself as soon as the oxygen in solution in the water becomes less than 0·3 per cent. The best means of preventing stagnation consists in keeping the water in motion, and there is no better way than forcing air into the bottom of the reservoir, and keeping the water aerated. Mr. Brush gave an interesting account of his experience with a number of reservoirs where the water had become tainted in consequence of lying stagnant, and in every instance he obviated the difficulty by forcing air into the reservoir or the mains.

Electric Lights without Wires.

Professor J. J. Thomson has prepared a number of vacuum tubes in which there are no electrodes, but which are surrounded by coils of insulated conductors connected with batteries of Leyden jars. These tubes contain a little gas, of sorts, remaining after they had been exhausted in the ordinary way, and every time the jars are discharged through the surrounding conductors, the insides of the tubes are filled with light, which varies in color with the kind of gas contained therein. A Wimshurst influence machine furnishes the electricity, and the display is an exemplification of the connection between induced electricity and the phenomenon of light.

AN ATTACHMENT TO COOL WATER IN MAINS.

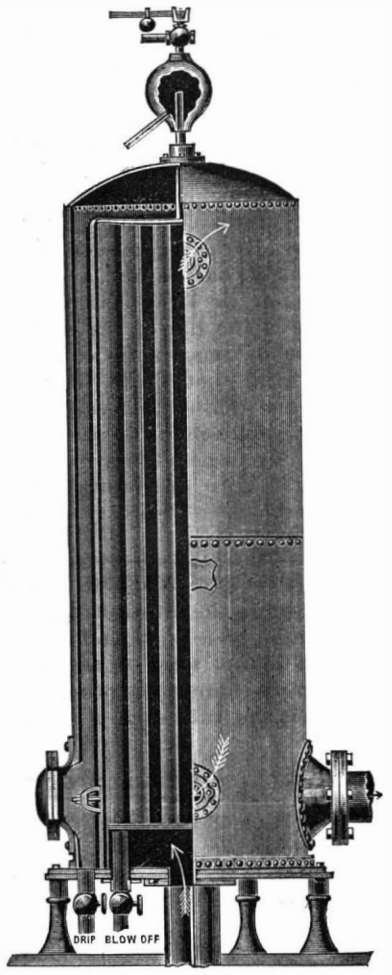
An improvement by means of which the water carried in main service pipes, for use in cities or towns, may be cooled during its passage to be fit for drinking in warm weather, without the addition of ice, forms the subject of the accompanying illustration. It has been patented by Mr. Arthur B. Wood, of Port Byron, N.Y. As shown in Fig. 1, the water main is supported upon a suitable foundation, and lying close to its top are cooling coils connected by a coupling to suitable nipples extending out from a heading, which is divided into a series of valve chambers having channels communicating with each other, and right angle channels leading into the coils. Fig. 2 is a detail view of one of the valves, a three-way valve having a bottom fitting on the base of the heading, and an outwardly extending stem with squared end and screw-threaded portion on which is a binding nut. The valves are opposite the ends of each pipe, to turn on or cut off the refrigerating material, Fig. 3 being a section through the end of two pipes and the valves, and Fig. 4 being a similar view showing the valves turned to cut off the sections. The inlet pipe through which the refrigerating material is forced from any suitable source of supply is connected with the heading opposite the top coils, the discharge pipe leading therefrom at its lowest portion. The coils are held in position by a top casing, made in flanged segments which can be readily placed in position or removed, the inclosed chamber formed by the casing and the water main to be filled with brine or cold air introduced by a pipe at one side and discharged by a pipe leading from the opposite side. The chambers are preferably covered with asbestos, sawdust or other non-conductor of heat. The sectional construction permits the ready removal of any coil, should it become rusted or stopped up, without interfering with the working of the system, the valves being turned to admit the refrigerating material only to the coils desired. In operation, it is designed to force anhydrous ammonia or other suitable refrigerating material into the heading and through the cooling coils, surrounding the top of the main for a short distance only at a convenient point for cooling the water for a certain district or town, the apparatus being duplicated as required when an extended territory is to be covered.



WOOD'S REFRIGERATOR FOR WATER MAINS.

A FEED WATER HEATER AND PURIFIER.

The accompanying illustration represents a feed water heater which is itself practically a boiler, and is designed to heat the feed water to or above the boiling point. It is a plain tubular heater, the whole of the shell of which is surrounded by a steam jacket. The steam enters a central compartment at the bottom, passing up through the tubes, around which the feed water circulates, and thence down on the outside of the shell, thus entirely preventing the radiation of heat from the water. The feed water is fed in at the lower end of the shell and drawn off at the upper end. A hollow cast iron ball or scum chamber is arranged at the top for the purpose of collecting the impurities which rise when the water is boiled, this chamber being ordinarily blown out four or five times a day. A blow-off and drip is also provided at the bottom, as well as a suitable hand hole through which sediment may be removed.



THE BARAGWANATH FEED WATER HEATER.

This form of feed water heater and purifier has had such extended practical use that its merits have become well known. It is strong and safe, and cannot cause any back pressure, but rather, acting as a surface condenser, is designed to reduce any back pressure that may exist. The heating surface is very large in proportion to the size of the heaters, which are rated at 1 H. P. per sq. ft. of heating surface, so that it heats the feed water to or above the boiling point, keeps the boilers clean in ordinary water. This, it is claimed, is the special merit of the Baragwanath boiler, that the feed water is more effectually purified by being boiled before it is fed to the steam boiler, while the destructive practice of feeding cold or merely lukewarm water is avoided.

In this heater the tubes are of heavy brass, and the slight variation in the degree of expansion between the brass tubes and the iron shell is provided for by spring tube sheets, which are made slightly concave. Both the shell and tubes are in contact with the hot steam and not exposed to the air. The heater is also made in inverted form for use in locations where it is more convenient to have the exhaust enter and leave at the top, and a horizontal heater is provided for use in cramped engine rooms. The latter is adapted to be set on top of the boilers in saddles, or hung from the roof. It has also been found particularly convenient for marine use, as it is not top heavy and can be suspended from the deck.

The Baragwanath feed water heating and purifying apparatus also includes a live steam feed water superheater and purifier, which is not designed to do away with the exhaust steam feed water heater, but rather as an auxiliary to it in certain cases, as where heaters are used which do not boil the water, or where the water contains impurities that cannot be removed by boiling. The latter heater and purifier consists of a heavy boiler iron shell, with removable heads, and containing a series of slightly inclined shelves or pans over which the water flows in direct contact with the live steam from the boiler. When the shelves have become coated with scale they are drawn out and cleaned, the bottom of the superheater and the settling chamber being cleaned at the same time.

This line of steam jacket feed water apparatus is made at the Pacific Boiler Works, Wm. Baragwanath & Son, 40 West Division St., Chicago, Ill.

The Largest Plank in the World.

The *N. W. Lumberman* gives an engraving from a photograph of a redwood plank that is 16 feet 5 inches wide, 12 feet 9 inches long, and 5 inches thick, and is about 90 per cent clear. It was taken from a tree 35 feet in diameter and 300 feet high. According to its rings it was more than 1,500 years old. The tree was cut 28 feet from the ground, and the plank was hewed out of the stump, representing a section taken from near the heart to the bark. After it was displaced it was lowered by block and tackle, with a locomotive for power. In the way of labor its cost represents the time of two men for a month, simply to prepare it in the rough for shipment. To this the cost of transportation must be added, making a total of about $3,000. It was moved by water to San Francisco.

After being on exhibition some time, a car was specially prepared to transport it to Chicago. This was done by cutting a slot in the center of a flat car, in which stirrups were pendent. The plank was placed on edge in the slot, its lower edge being within about a foot of the ties.

The plank was cut on the lands of the Elk River Mill and Lumber Company, in Humboldt County, Cal., is the property of J. L. Harpster, of Eureka, and B. F. Noyes, of San Francisco, and is on exhibition in Detroit, Mich., whence it may be sent to East Saginaw and elsewhere, to finally bring up in Chicago at the world's fair. The plank shows coarseness of growth, with richness of figure, and a finish such as the highest quality of material and the best efforts of Berry Brothers, the varnish manufacturers, of Detroit, can secure.

Wolfram Mining in New Zealand.

Wolfram, or tungsten, belongs to a group of rare metals, and till a comparatively recent time was known only to the chemist, and its value was only in the laboratory. With the invention of 100 ton guns the demand for tungsten soon made that previously obscure metal well known throughout the mining world. It was soon found that the steel tube lining the bore of these enormous guns could not resist the shock entailed by discharging many shots without becoming fractured, when of course an expensive piece of ordnance became useless. Experiment proved that the addition of a small quantity of tungsten to the fine steel employed in gun making rendered the latter metal wonderfully elastic, so that the steel tube will expand under the tension of firing and contract again to its normal size a great many times before the quality of the metal is in any way impaired. The German gun factories consequently absorb most of the tungsten found in the world, and from being a mere curiosity seen only in the laboratory of the chemist, this rare metal has acquired considerable value. Wolfram (erroneously called tungstate of iron in the cablegram) generally occurs in combination with iron in Europe, but is also found in scheelite, or tungstate of lime. It is in the latter form that it occurs in Otago. The metal itself is of a white color, extremely brittle, and heavy, the specific gravity being 19·1, that of gold being 19·3. It will thus be seen that tungsten is a very heavy metal, being only very slightly lighter than gold.—*Otago Daily News.*

OF the entire human race, 500,000,000 are well clothed, that is, they wear garments of some kind; 250,000,000 habitually go naked, and 700,000,000 only cover parts of the body; 500,000,000 live in houses, 700,000,000 in huts and caves, and 250,000,000 virtually have no shelter.

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Nerves and Narcotics.

In the May number of the Breslau *Deutsche Revue*, reproduced in the *American Analyst*, Dr. Adolph Seeligmuller discusses the universal subject of nerve troubles as follows: Excessive, exhausting, and too long-continued work, insufficient or irrational recreation, and deprivation of the right amount of sleep are some of the main causes for the increase of nerve troubles in our day. The competition in all the professions and callings is so great that for every person whose powers fail, ten are ready with fresh strength to perform the same or greater labor for the same or even a smaller remuneration. All exciting and weakening amusements should be done away with, and the quiet joys of family intercourse, the conversation of intimate friends, and sociable walks in the fields and woods should take the place of brilliant evening assemblies. Then every person should pursue some agreeable occupation besides his regular profession, and in the latter he ought to have frequent hours of relaxation to relieve the strain. Mental application, even for healthy adult persons, ought not to be continued for more than three or four hours at a time, and night work it would be best to avoid altogether, as the excitement is apt to interfere with sleep.

All who follow intellectual pursuits ought to have several weeks of complete rest at least once a year. Sleep is, however, the principal agent of recuperation. The amount of sleep needed is different for different persons. For the ordinary worker from six to eight hours is absolutely necessary; yet how often, in the battle for existence in our time, is the desire for sleep forcibly suppressed and the night's rest improperly shortened. Sooner or later insomnia wreaks its vengeance on the offender. Many a person who once robbed himself of the necessary amount of sleep would gladly sleep now, but cannot. I do not hesitate to say that nerve troubles first develop into disease when joined with sleeplessness. It appears as a latter symptom of a long-standing nervous disturbance, but to the lay mind it appears as the first sign of disorder, and is frequently taken to be the cause. The worker of the nineteenth century works beyond his strength, and in order to keep it up he resorts to stimulants—coffee, tea, spices, alcohol, tobacco. These produce a superexcitation of the nerves, which brings in its train insomnia; and to overcome this he resorts to narcotics. The life of many of our contemporaries consists in taking artificial stimulants to enable them to perform their work, and then resorting to powerful narcotics that can counteract the artificial stimulation and produce rest and sleep.

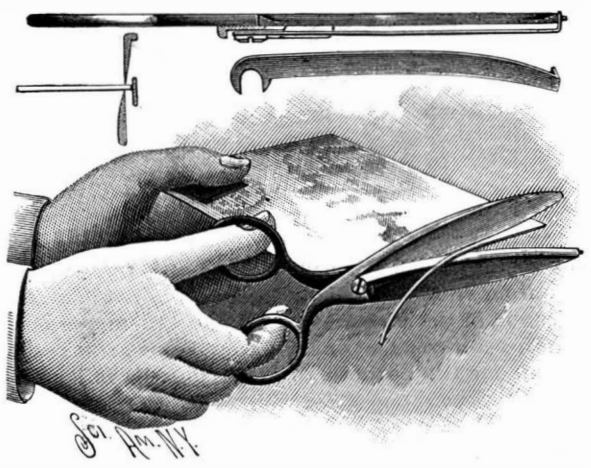
Any one can see that this alternation of stimulation and depression at least once every twenty-four hours must weaken the nervous system. Coffee is a powerful stimulant for the heart, and, therefore, those who suffer from palpitation, from hysterical conditions, or from insomnia should avoid its use. Tea in day time acts more mildly on most people; but taken evenings it drives away sleep. The spices are less active nerve stimulants; yet pepper, especially, and some of the others affect the nerves of the digestive organs powerfully, and their liberal use in modern cookery has something to do with the epidemic insomnia. Of the injurious, the actually destructive effects of alcohol taken in excess little need be said. We physicians are not a little to blame in that we insist on giving large quantities of alcohol in fevers and conditions of exhaustion, not to speak of the methods used to cure the morphine habit, until patients often acquire the drinking habit. The evil results of the abuse of alcohol are not often apparent. Long before *delirium tremens* or other serious brain diseases appear, they are preceded by manifold nervous disturbances, the real cause of which is not often understood. I have frequently found that rheumatic pains that were ascribed to a cold were nothing but alcohol neutritis, a mild form of inflammation of the nerves resulting from the use of alcohol, which disappeared when the practice was given up, only to return with the slightest repetition of the indulgence. Most habitual drinkers, and some of them very early, are subject to changes in the vascular organs, such as fatty degeneration of the heart and arterio-sclerosis, which lead to grave affections of the nervous system, like apoplexy and softening of the brain. Finally, it may be taken as proved that the children of drunkards, if they are not carried off prematurely by brain troubles, are frequently afflicted with serious nervous ailments, such as epilepsy, idiocy, and the like.

Tobacco has come to be in our time a national poison in many countries, and most especially in Germany. As sequels of chronic nicotine intoxication may be noted without fear of contradiction: Palpitation and weakness of the heart; irregularity of the pulse, of which heart pang or *angina pectoris* is an acute symptom; general nervous debility; tremulousness; disturbances of vision, even to the point of blindness; and hypochondriacal depression even to the degree of melancholia. The fear-inspiring intermission of the pulse is a frequent cause of inveterate insomnia. That the children of heavy smokers suffer with uncommon frequency from nervous diseases is an established fact.

And now for the narcotics, at the head of which stands morphine. The great danger of falling into the habitual use of this drug arises from the cowardice and degeneracy of our times. No one will suffer pain, no matter how slight or transitory. Not a tooth can be drawn, not a child born into the world without the use of an anodyne, and when death comes we must have euthanasia. It is said that many physicians lend their hands too willingly and are ready with the injecting needle to check a pain that could easily be borne, not reflecting that it is immoral to encourage effeminacy and a dangerous thing to plant the germ of the morphine habit, a terrible passion that leads inevitably to physical and spiritual debility and to death. The same is true of the constantly increasing cocainism and hasheesh intoxication. Our generation demands above everything narcotics to produce the sleep that first we drive from us, and afterward so fondly desire; opium, morphine, chloral, bromide of sodium, paraldehyde, hydrate of amyl, urethan, sulfonal, hypnon, somnal, and whatever are all their names—one would think names would soon give out, so fast are these children born. But how can we sleep without resorting to soporifics? Just as the life of the soul during the day is reflected in dreams, so the conditions of sleep are determined by all that we do when awake. The chief rule is to so act waking that you can sleep. Begin by accustoming yourself to do without excitants. Many a case of sleeplessness I have seen yield, when all other means failed, to restricting or totally abandoning for a time the use of spirituous drinks, coffee, tea, and tobacco.

IMPROVED SCISSORS FOR OPENING LETTERS, ETC.

The scissors shown in the illustration are adapted to do the work of ordinary scissors and shears, and are also so made that letters may be rapidly opened by them without danger of mutilating the contents. The improvement forms the subject of a patent issued to



WHEELER'S IMPROVED SCISSORS.

Mr. Nathan A. Wheeler, of Alpowa, Washington. The cutting blades are curved on their back sides, and one of them is somewhat thinner than the other, to allow it to close beneath a guide carried by the latter. The thinner blade also has, near its pivot point, a semicircular recess, terminating on the inner side in a shoulder adapted to engage a letter guide and throw it from the pivot pin. The figure at the top in the illustration is a sectional edge view of the scissors, and just below is shown the guide attachment used in opening envelopes. The screw by which the blades are pivoted together has an annular flange or rib below its head, forming a washer which bears upon the upper blade, and an annular recess between the washer and the screw head adapted to receive the letter guide. The latter is thin and flat, and curved to conform with the flanged back side of the thinner blade, so that when the blades are closed together it will fit the flange, the guide being secured to the other blade, so that its inner edge will be a little in advance of the edge of the blade. The guide is doubled over at right angles near its outer end and perforated to receive a stud on the outer end of the blade on which it fits, the inner end of the guide being rounded to fit the semicircular recess in the other blade, near the pivot point, and being slotted to fit closely upon the screw. When the guide is not in place the scissors are used in the ordinary way, but with the guide in position the end of an envelope passed between the blades is stopped by the guide, as shown in the small sectional figure at the left in the picture, so that only a narrow strip will be cut from the extreme end of the envelope, without danger of cutting anything it may inclose.

New Electric Car Motor.

Mr. Wm. H. Patton's new combination has lately been tried at Pullman with much success. The apparatus consists of a mechanical and electrical combination, as follows: A gas engine, dynamo motor, and storage batteries.

A gas engine is placed in position in the center of the car, resting on the trucks, and is geared direct to the dynamo by means of a friction pulley, no belts whatever being used. The dynamo furnishes the current for the motor, from which the propelling power of the car is obtained. In going down a grade, running on a level piece of track, or carrying a small load with a car whose generating power is entirely self-contained, there would necessarily be a surplus of current. The storage battery is arranged to take up this surplus current that would otherwise be wasted. A gas engine ordinarily is started by hand power, but here the current of the batteries is thrown on, which starts the engine, after which the batteries are thrown off and the dynamo generates current for the motor.

Treasures of Earth's Interior.

A scientific scheme of much importance has been agitated in Washington recently. During the last two Congresses there have been a number of representatives and two or three senators who have used their influence in favor of an appropriation for boring a hole in the earth several miles in depth. It has long been recognized that an inconceivable amount of value in the shape of precious metals and other mineral substances is locked up out of reach beneath the crust of this planet. All the riches dug out of it represent merely the most superficial and ineffective scratching of the surface. Once render accessible the internal recesses of the sphere, and it is plain that every human being might be a thousand times a Monte Cristo.

Geologists are agreed that the interior of the earth is largely composed of metals. Whereas the surface matter of the planet weighs only about two and one-half times as much as water, it is known as a fact that toward the center the average weight of things is eleven times that of water. This is due to the circumstance that while this sublunary orb was cooling and condensing, the heavier particles sought the middle. Therefore it is probable that the great mass of the sphere is iron. But there are other metals more heavy than iron, and these would naturally form an accumulation immediately about the center of the globe. Among them may be mentioned most importantly gold. Geologist Gilbert, of the Geological Survey, said the other day that he would rather expect to find a vast accumulation of gold at that point than anywhere else, his notion being that such of the yellow metal as is found on the surface of the earth is only an accidental detritus. However, there are two or three substances known even more weighty than gold, and one of them is platinum, which has doubled in market value within the last year or two, owing to the increased cost of production.

So it is not unreasonable that certain members of Congress and other persons of keen judgment should consider the advisability of boring a hole in the earth for the purpose of extracting some of its metallic contents. For scientific purposes a pit has recently been sunk at Speling, in Germany, to the depth of a mile. Unfortunately, water has been struck, and no results which add very materially to human knowledge have thus far been obtained. Another well has been driven at Wheeling, West Va., as far down as three-quarters of a mile. It is dry, and the boring process is proceeding at the rate of about ten feet a day. The management will be disgusted if oil or something is not struck before the hole comes out at the antipodes and somebody tumbles into it at the other end.

No really scientific person has been so foolish as to imagine that possible results, commercially speaking, could be secured without digging much further than this. Estimate is made that at twenty miles from the surface of the earth every known substance—metals, rocks, and all—becomes fused and liquid. Once let this point be reached, and naturally whatever is below must spout up of its own accord, without expense of mining. Immediately the price of metals in the market would be reduced to little or nothing, and a new age would dawn upon civilization. It has been suggested that such an artificial conduit would be, to all intents and purposes, a volcano, but any dangers which it would otherwise threaten might be obviated easily by establishing the works on an open prairie.—*Washington Star.*

Phenacetine in Influenza.

"Dr. Henry, St. Mary Cray, Kent, recommends phenacetine during the first stage of influenza. Its action, he says, is prompt and striking, so that many patients declare they have derived more benefit from the 'powders' than from anything else. It rapidly cures the headache which is such a distressing symptom at first, helps to reduce the temperature, and mitigates, but does not entirely remove, the aching of the limbs, a few doses of salicylate of sodium effecting its final removal. He gives the phenacetine in five-grain powders, repeated every four hours, till the headache and other pains cease. He has used phenacetine largely in a variety of conditions, and considers it is unrivaled as an analgesic. It seldom fails, it is comparatively cheap, tasteless, and, as far as he can see from a tolerably extended experience of it, is totally free from the unpleasant after-effects—depression of heart, etc.—sometimes caused by antipyrine and other drugs of its class. Insolubility is its sole drawback."—*British and Colonial Druggist.*

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EVOLUTIONS AND DRILL OF THE N. Y. STATE NAVAL RESERVE MILITIA.

During the past month the movement in the direction of establishing a naval militia that would bear the same relations to the regular naval service that the State militias do to the federal army has received a practical exposition in this vicinity. The New York State naval reserve has been drilled and exercised upon the squadron of evolution, popularly called the White Squadron, and has thus had at its service the new ships of the American navy. The Navy Department holds that the encouragement of the naval reserve is good policy on its part, as tending to establish a species of sea militia at points liable to attack. The movement has gone so far that naval reserve battalions are organized at New York and Boston, in Rhode Island and in North Carolina; California has passed a law authorizing the formation of a battalion, and it is proposed to establish reserves at the following cities: Burlington, Vt., for Lake Champlain; Rochester, N. Y., for Lake Ontario; and at Cleveland, O., and Detroit, Mich.

The idea is to protect the lakes and coasts by volunteer organizations. The character of the work of the navy has changed so much in recent years that the idea has become a far more feasible one than it ever could have been in the old days of sailing vessels.

The New York reserve were mustered into service as portion of the State militia about two months ago, at the 2d Battery armory, in this city. After preliminary organization and drilling, the period for actual work upon the squadron of evolution was reached on July 21st. The White Squadron, under Acting Rear Admiral John G. Walker, with Commander J. W. Miller as commander of the reserve, was anchored in the Hudson River, near the foot of 23d Street. It included the Chicago, Newark, Boston, Atlanta, Concord and Yorktown, as vessels to which portions of the reserve were assigned. A programme of drill in New York Harbor was carried on, on July 21st, 23d, and 25th. On the first named days the reserve reported at 5 P. M., upon the training ship Minnesota, thence reporting three-quarters of an hour later upon their own ships. The first evening's work was the arming and equipping boats for cutting out and the exercising at different maneuvers by flag signal from the flagship. The second evening's work included the arming and equipping boats for distant service and practice with electric search lights and in night signaling.

On the third day the reserve reported on board in the morning. The steamer Stonington had been engaged for their accommodation, and part of the squadron started for Fisher's Island, lying off the Connecticut coast, at the end of Long Island Sound. The Stonington was for the time being supposed to be a war ship, and ranked as the flag-ship of the naval reserve. Her decks were rechristened with the names appropriate to ships of war. The trip was made under navy discipline, the men practicing the routine of "life aboard," as the Stonington went up the Sound. In the morning, on approaching Fisher's Island, the reveille was sounded, the reserve made up their beds, were mustered, inspected, heard the articles of war read, and attended religious service.

The evolutions at Fisher's Island occupied the next five days, and some features of the operations are presented in our illustrations. The stragglers of the fleet had reached the anchorage by Monday, and, in addition to the vessels named, the torpedo boat Cushing and the dynamite cruiser Vesuvius joined the rest.

On Monday, July 27, the work began in earnest. The reveille was sounded on the Stonington at 6 A. M., and fifteen minutes later all were ordered "on deck." After breakfast and an hour of liberty the boats were manned and the reserve went off to the ships to which they had been assigned. On each vessel they were divided into regular gun crews and placed under command of officers of the regular service. They were then shown where to get their equipments for service at the large guns, and next were instructed in the use of them. Each man was put through the form of loading. Then the commands were given to cast loose the guns, provide ammunition, load, train, fire, and secure, and the drill was gone through with dummy ammunition exactly as if in regular service. This closed the morning's work, which was devoted to the 6 and 8 inch guns exclusively. Dinner was taken upon the Stonington. In the afternoon the same style of drill and instruction was gone through with, the secondary batteries of Hotchkiss and other machine guns and small arms being the objective features. Taps were sounded at 10 P. M. The same general daily calendar was adhered to for the rest of the week.

On the next day, July 28, target practice with guns of all classes took place. Sub-caliber apparatus was employed. For the larger rifles a steel tube is inserted into the bore, which tube is carried on disks, so as to give it an axial position. For the Hotchkiss guns a dummy cartridge, with a short barrel holding a rifle cartridge, is employed. The targets were placed at 300 yards from the ships, floating on the water, and not giving, therefore, a steady object to sight on. The entire day was devoted to this practice.

On July 29, the fleet left its anchorage at 10 A. M., and steamed out to the north and east of Montauk Point for target practice with the large guns, with full caliber ammunition. A triangle with sides 1,500 yards long, and a base 700 yards long, was marked out; two boats containing observers with sextants gave the base and a target marked the apex. One by one the ships ran along the base of the triangle at a speed of four nautical miles an hour, and as they did so, fired at the target. The observers, as far as possible, plotted each shot, all shots falling within a given radius of the target counting as bull's eyes. The firing was considered excellent. The rapid-firing guns were next tried at a distance of 1,000 yards, and the target was demolished before all the ships had had a chance to fire. The fleet then returned to its anchorage.

On the next day the sham battle of Fisher's Island took place. The reserve, 165 in number, with sailors enough to make up a party of 700, manned the boats, and formed in line 100 yards out from the beach. A force of marines had been placed on shore to represent the defense. After opening fire with the rapid-firing guns, the attacking force landed under cover of the ship's artillery, and conducted a regular attack. The attacking party was finally given the victory. A brief assembly and drill on shore closed the work of the day. The concluding evolutions at Fisher's Island, on July 31st, included boat races by crews of the reserve, and one by picked crews from the Chicago and Newark. In the afternoon, a body of over 1,000 men, including the reserves, landed on the island and marched to the parade ground for dress parade. In the evening the Stonington started for New York, where the reserve, after appropriate ceremonies, disbanded.

During the evolutions much interest was manifested in this city and at Fisher's Island, and New London, Conn., the nearest port thereto. Numerous yachts and excursion steamers visited the scene, and many courtesies were tendered the officers of the squadron and the members of the reserve. The latter includes among its members representative names in many stations. Besides business and newspaper men, quite a number of professional men figure on the list, architects, physicians, lawyers, electricians, draughtsmen, and others appearing in the roll.

In more than one way good will be done by the promotion of this movement, which is certain to be widespread. It will not only give definite instruction and drill to a class of men who may be called on personally in defense of our coasts, but it will give the new navy a chance for the most beneficial kind of exercise. In times of peace its equipment and capabilities cannot be put to a more severe test than in the routine of precisely such work as the ships and personnel were called upon to execute in teaching and drilling their new militia.

Distribution of American Population in Accordance with Altitude.

Mr. Henry Gannett, Geographer of the Census, states in Census Bulletin No. 89 that about one-sixth of the people of the country live less than 100 feet above sea level, namely, along the immediate seaboard and in the swampy and alluvial regions of the South, and that more than three-fourths live below 1,000 feet, while below 5,000 feet are found nearly 99 per cent of the inhabitants. At great altitudes there are found only the most trifling proportion.

In the area below 500 feet is included nearly all that part of the population which is engaged in manufacturing and in the foreign commerce of the country, and most of that engaged in the culture of cotton, rice, and sugar.

The interval between the 500 feet and 1,500 feet contours comprises the greater part of the prairie States and the grain-producing States of the Northwest.

East of the 98th meridian the contour of 15,000 feet is practically the upper limit of population, all the country lying above that elevation being mountainous.

The population between 2,000 and 5,000 feet is found mainly on the slope of the great Western plains. In this region the belt between 2,000 and 3,000 feet is almost everywhere the debatable ground between the arid region of the Cordilleran plateau and the humid region of the Mississippi valley. Above 3,000 feet irrigation is almost universally necessary for success in agricultural operations.

Between 4,000 and 5,000 feet, and more markedly between 5,000 and 6,000 feet, it will be noticed that the population is decidedly in excess of the grade or grades below it. This is mainly due to the fact that the densest settlement at high altitudes in the Cordilleran region is at the eastern base of the Rocky Mountains and in the valleys about Great Salt Lake, which regions lie between 4,000 and 6,000 feet. Of these the extensive settlements at the base of the mountains in Colorado are mainly between 5,000 and 6,000 feet.

Above 6,000 feet the population, which is confined, of course, to the Cordilleran region, is almost entirely engaged in the pursuit of mining, and the greater part of it is located in Colorado, New Mexico, Nevada, and California.

While the population is increasing numerically in all altitudes, its relative movement is decidedly toward the region of greater altitudes, and is most marked in the country lying between 1,000 and 6,000 feet above the sea.

The density of population is greatest near sea level in that narrow strip along the seaboard which contains our great seaports. The density diminishes gradually and rather uniformly up to 2,000 feet, where the population becomes quite sparse.

The average elevation of the country, excluding Alaska, is about 2,500 feet. The average elevation at which the inhabitants lived, taking cognizance of their distribution, was 687 feet in 1870; in 1880 it had increased to 739 feet, and in 1890 to 788 feet.

Learning the Principles.

Some engineers find a great difficulty in learning from books such things as are applicable in their business. The chief complaint from many engineers in regard to books is that they cannot understand the application of the information they contain, and in many cases there is good reason for this, but it is principally owing to their defective training when children. Many good engineers who have learned what they know by daily practice in the engine room, who have shown their qualifications by years of constant work at the business, and who are capable not only of taking care of the plant as it stands, but of erecting a plant and making it work successfully, are completely floored when they are called on for a rule that applies to any branch of the business, and yet at the same time in their own minds they understand the principles, and express themselves to the effect that if they knew the rules and could figure those things out, it would help them greatly in their practice.

A rule which will apply in a particular branch of work does not, as a general thing, contain anything that shows directly the application of the rule, and in fact, a rule is a simple statement of general principles that will apply almost indefinitely, and it is for this reason, perhaps, that they are confusing to those who have not been especially drilled in the comprehension of such methods of showing the results of special investigation and the methods of applying the principles, but a similar difficulty is experienced by those who have learned the rules and formulas from the book and have not been taught the general application, for, while the practically educated man is at sea, when rules and formulas are in question, so in a similar number of cases will the graduate meet with difficulties in his efforts to put his rules into practice. Formulas are even more confusing to those who have not been taught their use and application than are rules, but when once understood they are more serviceable and much more easily made use of.

Among the many engineers of my acquaintance, writes C. Davidson in the *Weekly Stationary Engineer*, I frequently find those who can best understand through the medium of the eye; that is, what they see worked out and put into practice, that they can thoroughly understand, for the eye has the faculty of following and the mind of noting every movement, every change, and every arrangement throughout the whole operation in a manner somewhat similar to that in which the skilled phonographer will follow the words of a rapid speaker, and these engineers who have once seen an operation performed can at any time thereafter go through the same operation themselves, even though weeks or months may have elapsed between the time when their attention was called to it and the time when they are called to do the same thing themselves. For reasons similar to those mentioned above, all men cannot have the same use of their faculties, neither can the same faculty be the strongest in all, but each man according to his aptitudes may become an expert in some branch from the use of faculties entirely different from those employed by others who are also expert in the same branch; but in spite of this, the purely practical man and the purely theoretical man can never be brought to agree on the same subject, although both may attain the same end by different means, simply because each looks at it from a different standpoint.

An Improved Ink.

This is for an ink which is permanent and unaffected by the application of acids, alkalies, etc., and which renders forgeries and erasures, additions or alterations easy of detection and difficult to accomplish. To carbon black (preferably prepared by the action of concentrated sulphuric or other acid on sugar) are added a solution of gum arabic or other mucilage, caustic soda, oxalic acid, and Indian ink. Vanadium in any form, Aleppo galls, nut galls, and a small quantity of an aniline dye are then added along with sufficient water to make the ink flow readily. The following proportions yield good results: Nut galls, 20 per cent; Aleppo galls, 5 per cent; carbon black, 10 per cent; "vanadium, 1 per cent;" Indian ink, 10 per cent; oxalic acid, 3 per cent; aniline dye, 1 per cent; rain water, 50 per cent. "The whole is boiled, filtered, and strained."

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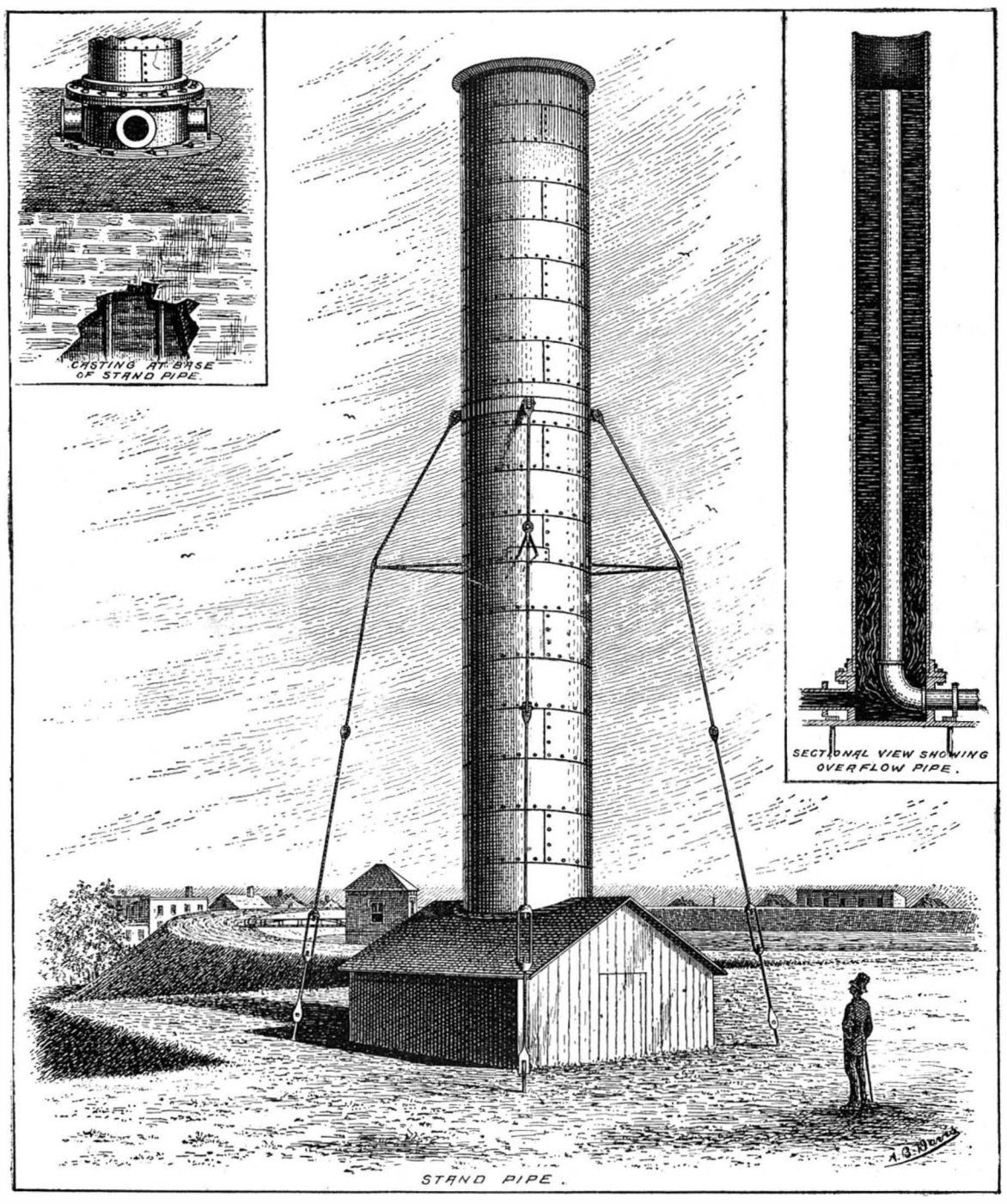
NEW HIGH SERVICE STAND PIPE, JERSEY CITY HEIGHTS.

This stand pipe was erected for the purpose of forcing water above the first floors of houses on Jersey City Heights. The pipe is 100 feet in height and 6 feet in diameter. It is put up in twenty-two courses of wrought iron, of three different thicknesses. The first seven courses are made of ½ inch iron, seven of the next out of ⅜ inch, and the last eight out of $\frac{5}{16}$ inch iron. Each course was put up in two separate pieces and riveted together. Each course is 4 feet in height. The stand pipe is riveted at the bottom to an iron casting, 8 feet in diameter. The casting has one 24 inch inlet and two 24 inch outlets. One outlet connects with the street pipe and the other to the overflow pipe.

The overflow pipe, which is erected inside and running up through the center of the main pipe, is 80 feet in height and 2 feet in diameter. This is connected to one of the outlets in the casting and runs out into the reservoir. The casting is bolted to a brick foundation 15 feet square. The bolts are eight in number and 2½ inches in diameter. They run through the foundation and are fastened on the under side to iron washers, 2 feet square. The weight of this casting is 12,000 pounds. The weight of pipe is 32,000 pounds. The pipe, when full of water, will hold 21,000 gallons. The water is forced up into the stand pipe at the bottom through a 24 inch pipe connected to the casting, by a Worthington duplex engine. The four iron supporting rods for the stand pipe are 1½ inch in diameter. The stand pipe was erected by Theodore Smith, of Jersey City, at a cost of $5,500.



NEW HIGH SERVICE STAND PIPE, JERSEY CITY HEIGHTS.

Color Blindness.

A railway engine driver, forty years of age, was dismissed from his situation because he was unable to correctly distinguish colors. Dr. M. Reich, who examined the man, and who afterward published the results of his examinations in a Russian paper, found sight, focus, and sensation of light normal, and discovered no disease by the ophthalmoscope, yet the patient could distinguish no colors when of a dark shade, and only yellow and blue when of a light shade. With the help of a red glass he could distinguish the figures on Tables II., III., VII., and VIII. (Stilling). The patient assured Dr. Reich that he had been able to distinguish colors correctly and with confidence up to the summer of 1889. He said that through over-exertion and insufficiency of sleep he had then suffered from violent headache for two weeks, and that afterward he saw everything as if it were red. The latter symptom had continued for three months, after which time he had lost all sensation of color. In the beginning of May, 1890, he presented himself again, declaring that he had perfectly regained the power to distinguish colors. A thorough examination completely confirmed the assurance given by the patient, who was consequently again fit for service. Dr. Reich believes that "erythropsy" is due to central mischief. The case seems to show that sensation of color is perfectly independent of the physiological function.—*Lancet.*

Colored Photos.

Beautiful effects may be produced with the new positive films, that will find ready sale; and as the process is so simple, and the results so beautiful, any one may produce good results from the first. Dealing with portraits may require a little more careful handling, still the process is not difficult. It will probably be as well to try on a landscape first. Procure a landscape negative and print slightly on albumen paper, making a very weak print when fixed—toning not necessary; washed and dried, by adding a small quantity of glycerine to the last wash water the print will lie flat when dry, and be less troublesome in after manipulations. After the print is dry, color according to taste, making the coloring as brilliant as possible. Now fasten to the colored side a film positive which has been printed from the same negative. The two combined will produce very artistic effects, and will meet with ready sale. To one who knows nothing of how they are produced, the effects are very puzzling, and when well and carefully done the picture is really artistic and beautiful.—*St. Louis Photographer.*

Spontaneous Fires.

The number of fires due to what is commonly called spontaneous combustion is probably much greater than is generally supposed. An innumerable number of substances are liable to undergo the process, and as a good deal of ignorance appears to exist in regard to the conditions which are necessary for its development, it seems worth while to offer a few hints on the subject. Many organic and some inorganic substances, when exposed to the air in a moist state, absorb oxygen, and so develop heat. The rusting of iron, the decay of leaves, and the putrefaction of nitrogenous matters, are examples of this kind of action. In ordinary cases the mass of oxidizing matter is small, and the heat, consequently, being speedily dissipated, has but little intensity, or is even quite insensible to ordinary tests. Heat is, however, always produced, and when, as in a hot bed, the mass is considerable, the intensity becomes notable. When large masses are concerned with sufficient supply of air, but without the possibility of free ventilation, the heat sometimes becomes so intense as to produce actual combustion. In a few well known cases this takes place in contact with water. Thus, cotton closely packed in a moist state, on board ship or in warehouses, has been known to become ignited, and serious fires have arisen from this cause. Hay stacked while moist always becomes greatly heated, and not unfrequently gets thoroughly charred, or even bursts into flame, and the same phenomenon has been observed in barns and granaries. Many fires in country places are, no doubt, due to this cause, and probably some that are ascribed to arson. Coal, which contains much pyrites, absorbs oxygen and becomes heated rapidly when moist, and although proof is commonly impossible, it is generally believed that fires particularly at sea, have often originated in this way. But the greatest danger arises when cotton, hemp, jute, flax, or even sawdust or charcoal, saturated with oil or turpentine, is stored in masses. Under such conditions, the supply of air being limited, spontaneous combustion is sometimes a matter of certainty. We do not wish to exaggerate the danger of spontaneous combustion. Most fires are probably due to gross carelessness, particularly in the matter of lucifer matches, which are often used with amazing recklessness, or to the too close proximity of woodwork to stoves and open fires. But it seems certain that risk of the kind we have indicated is constantly incurred in ignorance, and we hold it to be a public duty to point out to all, but particularly to warehouse men and ship owners, the character and the causes of the danger which besets them.—*Insurance Journal.*

Keeping a Steady Temperature.

Gentle reader, did you ever try to run an incubator in cold weather? If so, did you have thermometers in different parts of the machine, and note the remarkable variations in temperature and lines of currents of air. In a warm room, in cold weather, the slightest crack in the wall, or pin hole that lets in cold air, is sure to create a current that alters the temperature all along the banks of this current. Ordinarily we do not notice these things, but if you have several hundred eggs under your charge, and you know that a variation of four or five degrees of temperature will destroy them, you necessarily become a close student of temperature.

Now the dairyman is not in so close a hole as is the man who runs an incubator, but at the same time he is dependent to a very large extent for success upon the care with which he looks after the temperature he has to deal with. In the cheese vat he will find several different temperatures in different parts of the vat. So it is with the cream vat or churn. Not only do these different parts vary, but no one of them retains a given temperature for any length of time. All sorts of outside influences are constantly at work changing each part of the vat to a hotter or colder condition. For this reason, when you are getting a vat of milk or cream to a certain temperature, and you find you have reached the correct degree, it will not do to take out the thermometer and go about some other work. The chances are a hundred to one that the milk will not stop where you want it to, but it will go on getting higher or lower, and you must reverse the action to bring it back again. Eternal vigilance is the price of a steady temperature.

There is nothing of equal importance with temperature in the dairy, whether it be in the stable, in the milk room, in the factory, or in the utensils, everything should be done at stated degrees of heat or cold, and for this reason the man in charge should be a close and intelligent student of temperature.—*New Dairy.*

Explosive Medicine.

In the June number of the *Therapeutic Gazette* reference is made to an article which appeared in *La Pratique medicale* for May 5, calling attention to an accident that had happened from carrying chlorate of potassium tablets in the pocket. The tablets had been prescribed for a patient who was suffering from ulcerative stomatitis, and he was in the habit of carrying the medicine about with him. One day, as he sat down, a detonation was heard, and before he could remove his clothes he was seriously burned. The tablets, wrapped in a piece of paper, were carried in his pocket together with a penknife, and it is supposed they detonated under the influence of concussion and set fire to his garments.

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THE MEXICO, MO., TORNADO.

BY JAMES NEWTON BASKETT.

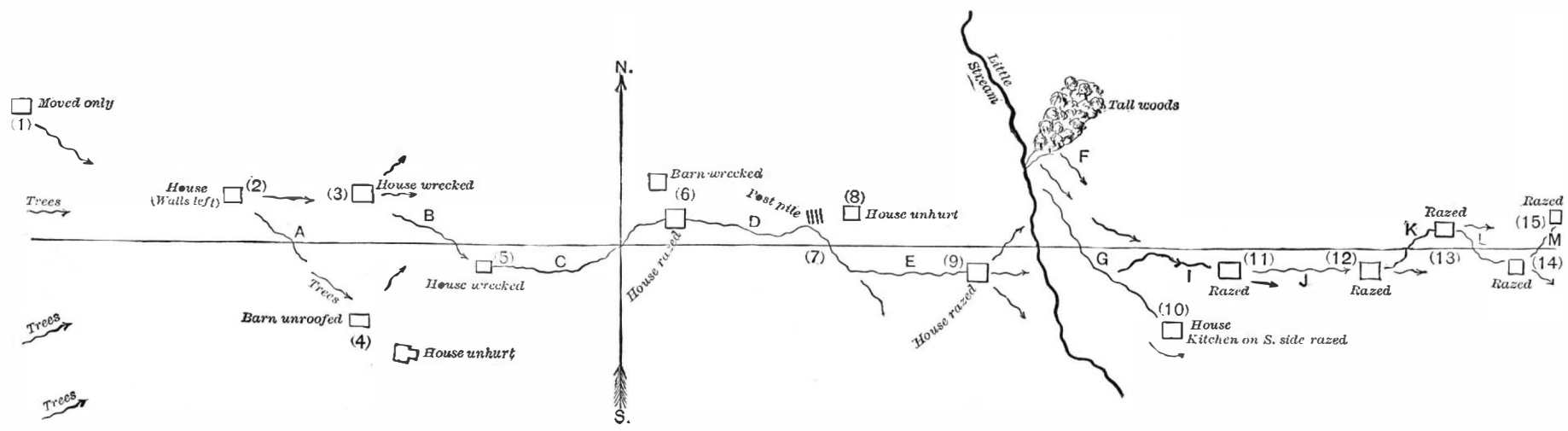
The Missouri tornado of May 20, 1891, was, perhaps, one of the most accurately timed storms of record. By the station clock, at Mexico, it broke the wires of the Chicago and Alton Railroad, two miles west of Centralia, at exactly 3:18 P. M., and broke the wires of the same line, two and one-half miles east of Rush Hill, at 3:45 P. M.; time, 27 minutes; distance, twenty-eight miles. The storm's general route was more direct and somewhat shorter than the railroad's, but it zigzagged enough to compensate for this. Its rate, therefore, was a mile a minute, "including stops," but "between stations" it must have been much greater, for when doing its most destructive work it appeared to halt or move slowly. One observer states that it played before him as he trotted quietly in its wake, and that he could easily have overtaken it had he cared. There are other evidences that this is true.

When first seen west of Centralia—fourteen miles west of Mexico—the storm cloud had five of the usual funnel-shaped tentacles writhing high but harmless in the air. But they soon descended, massed themselves into one, and for six miles wrought a zigzag streak of great damage—worming itself this way and that, sometimes at right angles to its general course, to lick up a building. At the end of six miles it rose into the air again, and became obscured at each side and beneath by intervening clouds. During this flight its velocity and force were probably terrific, as its roar was heard twenty-five miles southward. At the end of nine miles it gradually descended again, showing several whirling funnels.

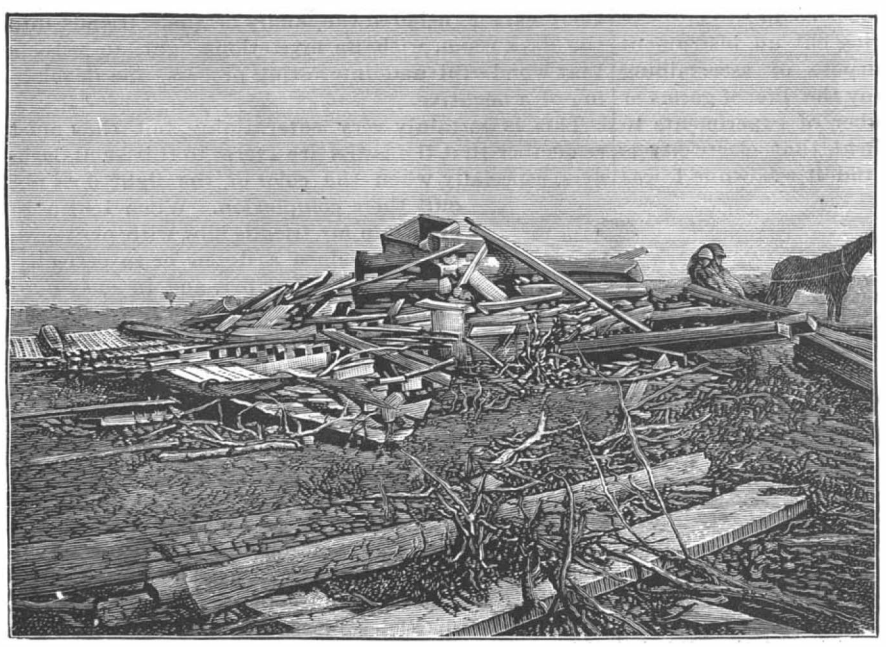
The external phenomena of this storm's march were perhaps not very peculiar. At the time of its greatest fury, a white steamy streak, apparently a foot across, was seen to run up and down and sway with the lambent cloud, and then to part in the middle, and the upper portion to slowly withdraw above. The funnel cloud was dark, when simply traveling, but steamy white when doing destructive work, its point touching its victims, at times, with the delicacy of a serpent's tongue. At some houses, however, the cloud seemed to lie in mass, and great, filmy tentacles, with vertical revolution, would dart violently out and in. These offshoots were also observed high in the air at other places. At times the main funnel was preceded by a smaller one, which would be overtaken and absorbed by the larger, with every appearance of an explosion.

The electric displays, while extensive, were not more remarkable than those accompanying large ordinary storms. The switch boards at Mexico (and perhaps other places) were burnt out, and, on the edge of the track, some stock were killed by lightning. In the direct path, immediately after the passage, some crisply burnt green leaves were observed, indicating, perhaps, heat, either electric or frictional; but none of those persons passed over by the funnel report any evidences of immediate electric action.

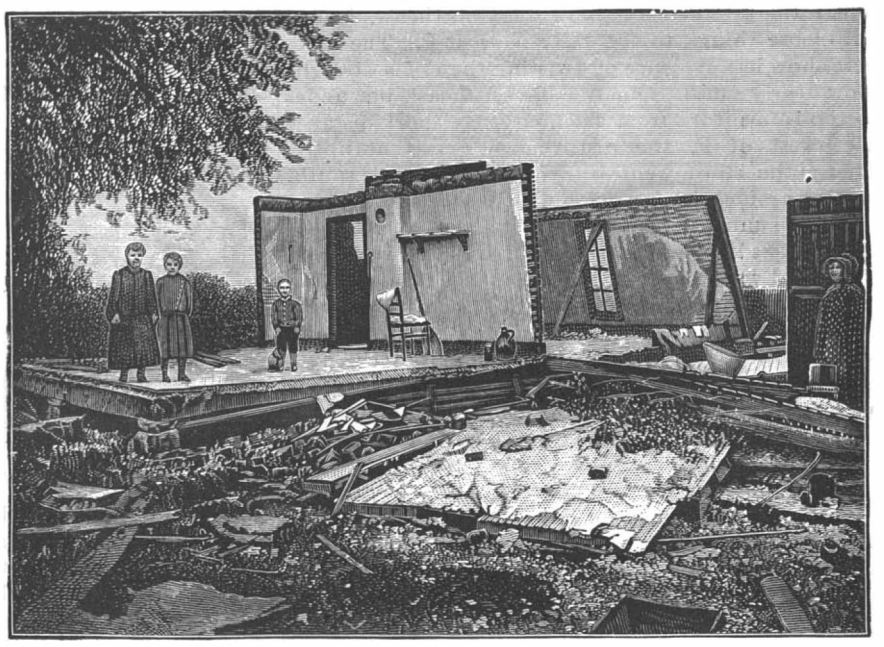
There are, however, some remarkable phases of this tornado's traverse that may indicate at least *electric attraction.* Noticeably, the storm crossed the county of Audrain for a distance of thirty miles on a township line dotted with homes, and left a straight line at no time the distance of a stone's throw, except to pick up a building. Near Centralia, in Boone County, its oscillations across its general course were as great as half a mile—at one time going directly north on a lane and demolishing two or three buildings. The study of the diagram (herewith) of the tornado's track north of Mexico will convince any one that upright objects had the power of attracting it from and deflecting it again out of the line of its march. House No. 1 was only slightly moved on its foundation. The direction of the trees shows a gathering of forces toward No. 2 (on a high point). This house (see engraving) was demolished but not swept away. Thence the main cloud goes on eastward with an offshoot southeast toward No. 4. Home No. 3 has the house and barn wrecked, and the yard filled with *debris* (see



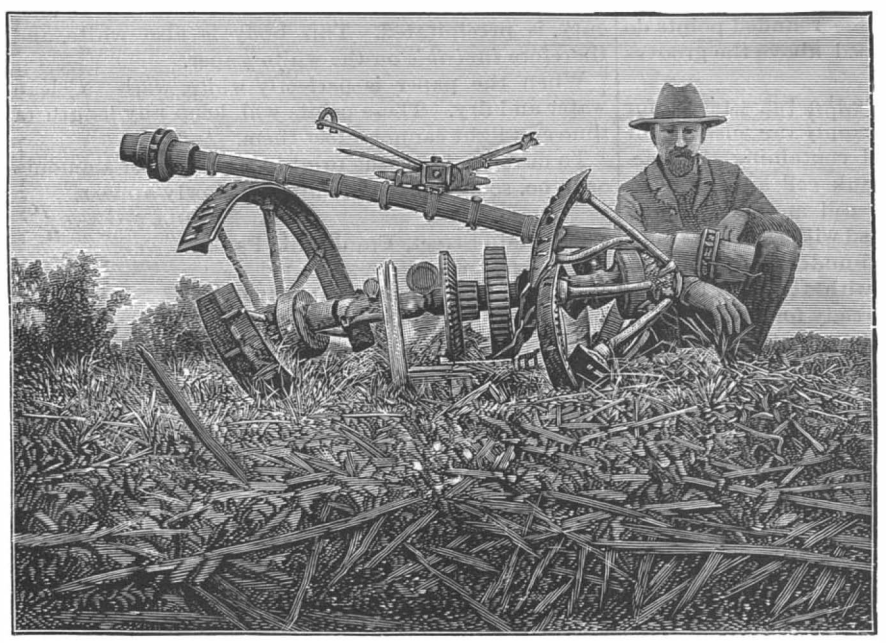
PATH OF TORNADO, SHOWING DIVERGENCES TOWARD ELEVATIONS.



DEBRIS OF BUILDING TORN DOWN AND WHIRLED TO NEW PLACE.



HOUSE DESTROYED AND WALLS LEFT STANDING.



MOWING MACHINE WRECKED BY THE TORNADO.

WRECK OF A HOUSE AND BARN

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engraving) and further east a log stable is demolished. No. 4 was a barn with the roof wrecked by a twister from along the line A, the house being left uninjured.

There is evidence that this offshoot rejoined the main storm whirl while the latter was at No. 3. The front fence of strong posts was borne down to the north, and trees near it hurled back southeast across it. When the whole left No. 3, along the line, B, it swept everything loose in a straight line after it, leaving the uprooted orchard trees strewn tops eastward. There are signs of a rebound at No. 5. Barn and house were only slightly strained, and a wagon was carried high over the former. Along C are evidences of only a straight blow with a southward tendency till it neared No. 6, when it veered quickly northeastward, leaving scarcely a vestige of the house, but only wrecking the barn, which was farther over. Along D it only strewed the *debris* of No. 6—straining now and then a post—till it came to a pile of fence posts at No. 7. At once the whirling motion takes place, and the standing fence is mowed down by the loose posts and all scattered for rods southeastward. This deflection saved the house at No. 8, only a few rods away, a tree in the front yard being swept nearly due south into the main track. Along E is a well marked swath, perhaps eighty yards wide, of broken trees, strained fences, and the grass swept along the line as with a water flood.

At No. 9 the tornado evidently struck the house first square on, and the whirling motion and deflections were secondary. The main part of the *debris* is carried eastward, but the floor system was whirled north into the road, back south and west into the yard, cutting a double swath through fence and shrubbery, and was dropped a few feet northwest of its original place (see illustration). Thence a blow went northeast, loaded with loose things, to the tall woods at F. The trees here show less evidence of twisting than of a straight blow nearly south. One tree lies southeast, but under its top is furniture from the house. A short distance northwest of F, the disturbance ceases abruptly. Thence the storm went to No. 10, forty rods south, passing around it, cutting only kitchen and leaving the house unhurt. There are signs that a portion of the straight blow continued on directly eastward from No. 9, and was joined by that from No. 10 almost immediately, for the hedge north of No. 10 is strewn with garments from the latter. At this point it first began to plaster objects with mud. Now note its path over Nos. 11, 12, 13, 14, and 15 (and there are others further on), crossing roads and hedges wherever an upright object stood. Here was a lane of fifteen or more homes, not one of which escaped damage.

The upward vortex motion of this storm continued long after it rose again; for objects as large as window sashes fell thirty miles from where it did its last damage, and lighter substances bearing names identifying them were found much farther east.

On June 2 following, we had at Mexico exactly the same condition of barometer, temperature, moisture and wind direction that we had on May 20, and yet no unusual disturbance. The New York *Herald* attempts an application of the Finley theory to our Missouri tornado. But all the conditions did not appear to exist. We had the moist warm south wind, but no cold dry northwest wind. Not until the morning of the 22d did any cold wind reach us, and that from northeast, and during and sometimes after our storm the area of low barometer was in the Dakotas, so that the trend of *all* our winds should have been northward as it was.

Our local weather service shows on 20th: Wind S. E. at 7 A. M., S. at 2 P. M. (just before storm), S. at 9 P. M. (after). Uncorrected and unreduced barometer 29·98 all day, rising next morn to 29·21 and remaining stationary all day. *Apropos* the barometer cannot be depended on as a tornado warner. During those of Marshfield, Mo. (one hundred and twenty-five miles south), and Louisville, Ky., this instrument stood at 28·35 and 28·21 respectively.

As to the theory of uprushing warm currents, we had nothing unusual in temperature for the season, but one reliable observer, at a short distance away, speaks of a hot wind rushing past him to the funnels. Precipitation in the immediate part of the funnel was comparatively slight, but on its outer edge—noticeably on its northern—hail stones, measured by reliable witnesses, fell—evidently from great height—measuring four inches through and weighing two pounds and over. On breaking up these irregular lumps, they were found formed around a spherical center drop. Some penetrated the plowed fields ten or twelve inches.

While this storm raged near Centralia, the smoke from the Mexico factories rose vertically to a great height, and was cut off suddenly by an upper current toward the storm.

The writer wishes to acknowledge valuable aid from Mr. J. F. Llewellyn, local observer for the State Weather Service, and from the graphic reports of the local papers.

THERE is no way to bend wood better or cheaper than by steaming.

Correspondence.

Remedy for Snails.

To the Editor of the Scientific American:

In reply to your snail correspondent, would state that large poultry will destroy them; at least it does so here. If he cannot keep poultry, I kept them under some by the following method: When working or visiting my garden, I carried a salt sprinkler, or cellar, in my pocket, and when I met any of the gentry, I sprinkled a small quantity on him. He needn't mind whether it is on head or tail; they don't seem to love it; in fact, it is certain death to slug or snail; but poultry works best. ONE THAT HAD THE PEST.

Stanton's Ginseng Farm.

To the Editor of the Scientific American:

My attention has recently been called to an article written by Nicolas Pike, entitled "The Ginseng," published in your valuable paper, January 10, 1891, in which Stanton's ginseng farm is located at Summit Station, N. J. The article in question refers to a subject which is of interest to a large class of the American people, and is calling out some correspondence which is being improperly directed to Summit Station, New Jersey. Will you kindly make correction in your next issue? There is a place called Summit, in New Jersey, but Summit *Station* and Stanton's ginseng farm are in Onondaga County, State of New York.

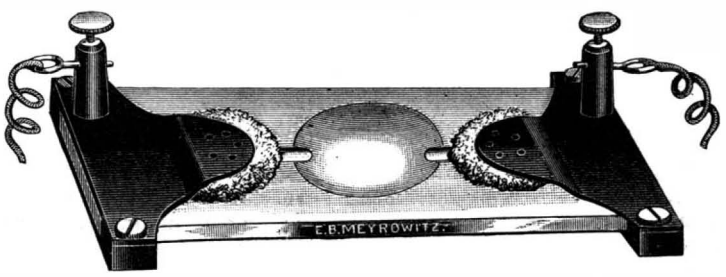
GEO. STANTON.

Summit Station, Onondaga Co., N. Y., July 27, 1891.

ELECTRO-MICROSCOPIC SLIDE FOR TESTING THE ANTISEPTIC POWER OF ELECTRICITY.

To the Editor of the Scientific American:

I represent in the accompanying cut an instrument devised by myself for the purpose of ascertaining whether electricity would destroy the life of germs or not. It is the result of a number of experiments to confirm the belief I have long held, that electricity is an antiseptic and disinfectant, and it was while I was



engaged in these experiments that I discovered that Apostoli had made the same claim.

The instrument consists of a glass slide, in the center of which is a sunk cell. Two grooves, each ¾ of an inch long, run from the sunk cell outward. Two brass pieces are fitted over the extremities of the slide in such a way that the rounded points, the under surfaces of which are lined with platinum, will extend over the outer ends of the grooves. These rounded points do not touch the glass, but are raised above the grooves about ⅛ of an inch.

Binding posts are attached to the brass pieces for connection with a battery. To apply the instrument a sufficient quantity of the fluid containing the bacteria should be used to fill the sunk cell and grooves. A cover glass is placed over the cell and its contents. Two small clean sponges saturated with either the fluid or distilled water are then placed underneath the platinum points and in contact with the fluid in the grooves. The bacteria are now ready for observation, the electricity is turned on and the quantity noted by the milliampere meter until all signs of germ life disappear. They can afterward be cultivated on gelatine in the usual way, if desired, to determine whether their vitality has been entirely destroyed. Other uses for this slide will readily occur to one working in the same field. For example the effect of electricity on the blood and different tissues. I have found this instrument very satisfactory, not only as an easy but as a quick way of finding out the amount of electricity required to destroy these micro-organisms.

ROBERT L. WATKINS, M.D.

320 W. 145th St., New York.

The Artificial Production of Rain.

To the Editor of the Scientific American:

I have read in our daily papers lately of the production of rain by means of mechanical appliances, and also by explosives, and that our government has set aside a sum for experiments by the latter process.

If they are successful, is there not great danger in store for us, as every person having the means could use these appliances and rob the atmosphere of its moisture? And what a wet time we would have! Those owning small water power would want rain nearly all the time to drive their increased machinery, while the tillers of the soil would want dry weather to develop their crops; but what is more serious to think of, what effect would the heat of the sun have on the earth if we drew all the moisture from the heavens or clouds above us? JAMES MALLEN.

North East, Md., July 29, 1891.

Emery Wheels.

To the Editor of the Scientific American:

In your issue of July 25 is the account of a so-called "singular and fatal accident" from the bursting of a 12 inch emery wheel, while running over 8,000 revolutions per minute. We can see nothing singular in this accident, as the standard speed is only 1,800 revolutions. People who violate the simplest rules for safety must expect to be killed.

It is not singular that a farmer should violate rules which a skilled mechanic would have observed. There is, however, a class of emery wheel accidents which is singular, and that is the class which arises from the use of wheels of types and varieties essentially unsafe. Of late years the craze for low prices has so demoralized buyers that they no longer pay much attention to the quality of goods, some of which are essentially dangerous and some essentially safe. Some responsibility ought to attach to employers who provide tools for their men's use without taking pains to procure those which are free from danger. It is a mechanical heresy that one emery wheel is as good as another. The truth is that there are a number of safe varieties and a greater number of unsafe ones.

THE TANITE COMPANY,
T. DUNKIN PARET, *President.*

Stroudsburg, Pa., July 30, 1891.

Invisible Photography Made Visible.

To the Editor of the Scientific American:

Most amateur photographers have at some time in their career ushered the family or their friends into the dark room, with its mysterious light, to witness that wonderful and interesting process—the developing of a negative.

This is certainly very entertaining, but they must remember that the ladies are averse to this semi-darkness, especially when the color of the light does not suit their complexion. When I wish to entertain my friends now with photography, I produce a dozen or so perfectly white sheets of paper, and in *open daylight, or lamp light,* immerse them one by one in a solution, and slowly a beautiful *positive* picture appears and remains permanent.

The process is as follows: Take an ordinary silver print, wash and fix in a solution (ordinary strength) of hypo. soda, with an addition of teaspoonful of bicarbonate soda to the pint. *No gold must be used.*

Wash the prints well, and immerse in a saturated solution of chloride of mercury. A part of the chlorine passes over to the silver of the picture and changes the brown silver particles into white chloride of silver, which is *invisible* on the white paper. At the same time subchloride of mercury (mercurous chloride), which contains less chlorine than the chloride of mercury, is precipitated. This body is also white, and therefore *invisible* on the white paper.

When the paper is perfectly white, wash in clean water and dry. These prints will keep any length of time and light cannot affect them.

To develop, place the print in a solution of ammonia or hypo. soda and the picture will slowly appear.

A. SMEDLEY GREEN.

4517 Main Street, Frankford, Pa.

Oddities about Fleas.

Nothing curious about a flea, eh? Let us see. Put one under a strong microscope. What a transformation! It seems to be clothed in armor "from head to foot" formed of brown, overlapping plates, that are so exceedingly tough as to be almost indestructible. Its head is small and very thin, with a single black eye on each side, the rays of light scintillating through the tiny optic like sparks of fire. Puget managed to look through the eye of a flea with his powerful glass, finding that its surface diminished objects in size while it multiplied them in number—a man appearing like an army of fairies, and the flame of a candle becoming a thousand tiny stars. From the shape of its head, and for other reasons, the flea is supposed to use but one eye at a time. The offensive weapon of the little creature is composed of two palpi, or "feelers," two piercers and a tongue. When it feeds it stands erect, thrusting this sucker into the flesh, and will eat without intermission if not disturbed.

The flea's manner of breathing is still undetermined, but it is thought to be through two small holes at the end of the palpi.—*St. Louis Republic.*

THE upper part of a room heated by a furnace is always hotter than the floor. The difference is not a uniform amount, but varies with the temperature outside, the colder weather making a greater difference between the floor and ceiling temperature. You may have 5, 10, or even 20 degrees difference between the floor and ceiling.

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GYMNASTIC EXERCISES WITH THE STICK.

Among the various forms of gymnastic exercises, some of the simplest and best are those that are performed with a stiff stick about five feet in length and three-quarters of an inch in diameter. It may be turned out of strong wood, but we consider as preferable a section of a bamboo pole, for it is light, strong and smooth. It may be cut from the smaller part of an ordinary bamboo fishing pole, which, undressed, sells for a quarter of a dollar.

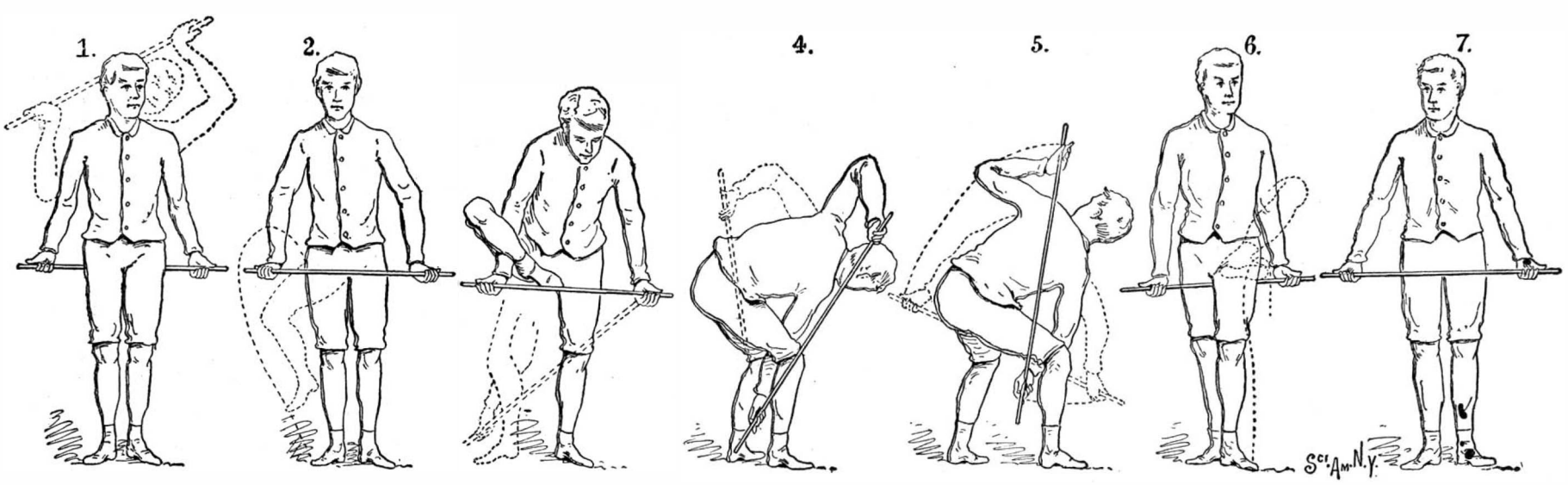
The stick is to be held by the hands in front of the body and the arms then lifted, and the stick thrown over the head to a position in the middle of the back. Inflate the lungs and hold the breath during the exercise. This may be repeated a number of times, and will be found excellent in developing the breast and lungs. With the stick held in the position last described the body may then be rotated, holding the knees firm and the feet with toes turned out. This helps to develop the muscles of the loins.

Then, holding the stick in a vertical position down the back, the body may be swayed back and forth sidewise, and in that way the various muscles of the back, loins and arms developed in a high degree.

We have now to call attention to a more difficult form of exercise with the stick, which is illustrated in the diagrams herewith presented. In the position seen in Fig. 1 the stick is held horizontally behind the body. Care should be taken to place the fingers and thumbs on the stick in the manner shown in the engraving. The next movement, shown in dotted lines, Fig. 1, still holding the hands upon the stick as first described, is to bring the stick over the head in front of the body, into the position shown in Fig. 2. It will be noticed that the elbows, in this case, are, by the movement described, bent outward. Take care that the stick is held in the hands as represented in Fig. 2.

The next movement, shown in dotted lines, Fig. 2, is to lift the right leg and place it over the right arm in front between the stick and the body, as indicated in Fig. 3, and to carry down the leg to the floor as indicated in dotted lines, Fig. 3, bringing the stick outside of the leg, which necessitates the stooping posture shown in Fig. 4; then carry the stick back along exterior of the body as shown in dotted lines, Fig. 4, to position shown in Fig. 5, thence along the body to middle of back, as shown in dotted lines, Fig. 5, and bring the stick up into horizontal position between the legs, as shown in Fig. 6. The last and final movement is simply to lift the left leg back over the stick, which will then be in front of the body in the position shown in Fig. 7. The exercise may be repeated in reverse order, commencing with Fig. 7 and going back to Fig. 1. This looks like a very simple exercise, but to those who are unaccustomed to its performance it will be found at first difficult to accomplish; but do not be discouraged. With perseverance, any person, young or old, can finally succeed. Its practice will be found of very great advantage in promoting the strength and suppleness of the muscles, not only of the arms and legs, but of the hands, wrists, knees, shoulders, chest, loins, back, and other parts of the body.

Exercises such as we have described are of the highest benefit to young persons o both sexes, who should make a practice of going through a series of them every day. They require but little time and for home gymnastics are unequaled. They are promotive of good health, beauty, and symmetry of the human figure.



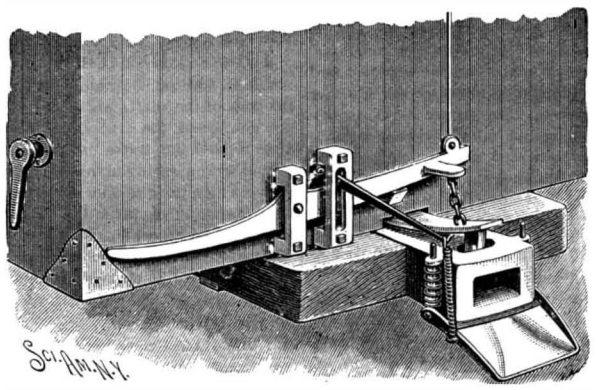
GYMNASTIC EXERCISES WITH THE STICK.

Power of Mental Impressions.

In 1862 Mr. Woodhouse Braine was called upon to give chloroform to a nervous, hysterical girl for the purpose of having two tumors removed from the scalp. In order to accustom her to breathing through the inhaler before giving her chloroform, he placed it over her face and she at once began to breathe rapidly through it. In half a minute she said, "Oh, I feel it, I feel I am going off." Immediately after she was found to be insensible to pinching and her muscles were flaccid. Both tumors were removed without her having taken a drop of chloroform, and after the operation she declared she had not felt a particle of pain. The doctor very facetiously adds: "To the time she left the hospital she firmly believed in the potency of the anæsthetic which had been administered." ("Influence of the Mind upon the Body," Tuke.)

AN IMPROVED CAR COUPLING.

The device shown in the illustration is adapted to automatically couple cars having drawheads of different height, and may be operated from the side or roof of the car for uncoupling. It has been patented by



BENTLEY'S CAR COUPLING.

Mr. William Bentley, of Lethbridge, Northwest Territory, Canada. The main portion of the drawhead is held between longitudinal timbers of the car frame, where it is supported by cross bars to have a sliding movement. At the inner end of the drawhead is a guide bar sliding through an aperture in a cross timber and a block, the buffer spring mounted on the guide bar cushioning the drawhead in the usual way. Upon the drawhead body is secured the rear end of a drawbar, the forward end of which has a rearwardly curved draught pin adapted to slide in a vertical slot intersecting the throat cavity of the drawhead near its forward end. The drawbar may be in the form of a flat plate spring, as shown in the illustration, or may be a rigid plate, with the forward portion hinged to the rear portion. A rocking lever is pivotally supported in a keeper on the end of the car, the outer end of the lever extending within convenient reach from the side of the car, a short arm near the inner end of the lever being connected by a link or chain with the outer end of the drawbar. A draught rod is also connected with the end of the rocking lever and extended to the roof of the car, whereby the lever may be operated from this position.

Directly above the drawhead is a longitudinally moving latch bar, whose motion is controlled by a pin and a spiral spring, the front end of the latch bar normally projecting under the rocking lever, so that when the lever is operated to raise the draft pin it will push back the latch bar, the lever being rested on the latch bar after the coupling link has been released to retain the draw-bar in uncoupled position. A pin on the drawhead enters a groove on the under side of the latch bar, and is adapted to push the bar rearwardly, and disengage the rocking lever, as the drawhead is moved backward by the concussion of opposing cars as they come together for coupling, the draw-bar then hooking the entering coupling link. A transverse rock-shaft is also mounted near the end of the car, with a handle bar projecting from each side, and this shaft has a short cam toe engaging a pin on the latch-bar, whereby the latter may be moved rearwardly to release the rocking bar and permit the drawbar to fall and engage its hook with an entering link. The rocking lever also passes through a second guard or keeper plate, through a vertical slot in which, above the lever, projects a pivoted rock-arm, connected at its outer end to a strong spiral spring, the lower end of which is connected to an apron, which the spring is designed to support in an inclined position to receive the free end of an approaching link, when the coupling is in the proper position, as shown in the picture. This apron is also pivotally engaged by vertically sliding, spring-pressed rods, and hangs pendent below the drawhead when unsupported. It is designed, by slight changes, to apply this improvement to the ordinary form of drawhead.

A Science Ship.

At a recent meeting of the Royal Society of Edinburgh, the Prince of Monaco read a paper, giving a description of a new yacht which he had specially built for the study of "Oceanography," and of the methods which he had adopted for carrying out the work. The yacht has a displacement of 650 tons, and was provided with steam power in such a way as to reserve as much space as possible for the arrangements necessary for engaging in serious scientific work, having in view at the same time the wants of family life. The engine room was sufficiently large to accommodate, besides the engines, various apparatus, including a dynamo, an ammonia freezing machine, and a water still, all of which were under the charge of one engineer. Besides being lighted throughout by electricity, the vessel was provided with a search light of 10,000 c. p. for illuminating the surface of the sea during night operations. Other special fittings were a refrigerating chamber and a cold chamber, several laboratories, winches, and cables suitable for making deep sea soundings. The actual equipment of the vessel allowed soundings to be made in the ocean to a depth not exceeding 8,000 meters, and of apparatus being let down to the bottom at depths up to 6,000 meters, with the least possible difficulty. The maximum speed of the vessel was 9 knots, but during scientific operations which required a low speed the rate might be reduced to 3 knots by using only one of the two boilers with which the vessel was fitted, thus economizing the consumption of coal.

The object of the Prince's investigations has been to investigate the direction and velocity of the great surface currents on the ocean and in the mapping of these he had made considerable progress. Oceanography would shortly be enriched by a chart of surface currents which he was preparing from the data furnished by the floats, to the number of 1,700, which he had thrown overboard in three distinct regions between Europe and America. Possessing exact and authentic information as to the departure and arrival of a great number of these floats, he had been able during the past three years to follow their successive appearances, and to construct his chart under conditions of exactitude which made of it an experimental document worthy of complete confidence as regarded the general direction and the mean velocity of the currents of the North Atlantic. Very valuable observations had also been made in zoology, and numerous new species discovered in the course of the operations.

Improved Refrigerator Cars.

We had the pleasure of examining, on the tracks of the Central Railroad of New Jersey, at Communipaw, two new Eastman refrigerating and heater cars, one an automatically heated and ventilated car for winter business, with late and important improvements; the other an automatic refrigerator car, constructed upon novel principles, the circulating air currents being, it is said, automatically controlled, so that a uniform temperature of any given degree can be produced and maintained by simply placing an index pointer on the number representing the degree of temperature desired, and when that given degree is reached, the unnecessary consumption of ice ceases, and a large saving, not only in ice, but in expense and delay occasioned by re-icing *en route*, is accomplished. It is claimed this car will safely carry fruit, or any freight requiring refrigeration, from California to New York, without re-icing *en route*

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RECENTLY PATENTED INVENTIONS.

Engineering.

HEAT AND MECHANICAL ENERGY.—Hermann Mehner, Hackettstown, N. J. This invention is for a method of transforming heat into mechanical energy analogous to the theory of Sadi Carnot relative to a thermo-dynamical cycle of operations, in which a substance is finally brought to the same state in all respects as it had at the beginning. The method is stated to consist principally in changing the heat form of energy into a physico-chemical form and *vice versa*, the additional heat which may be stored in water in which saltpeter is dissolved being used to illustrate the application of the invention. "By exhausting hot steam into the hot salt a full condensation takes place without the help of any cool substance or body, no heat being carried off, and the entire amount being locked up in the molten mixture, to be transferred into a suitable boiler and transformed into steam at a somewhat higher temperature, whereby steam of higher pressure is made, and at the same time saltpeter in a dry state is again obtained and also the absorbed heat, heating being done with crystallizing salt, and the steam after doing its work being again condensed by the salt." The use of other solvents or volatile solutions and combinations of salts is provided for, admitting of a large number of modifications of the process in its practical application, the end being in each case to use mixtures by which the heat now lost in operating motors may be recovered and returned to the cycle of operations of the motor, proceeding in reverse order as regards the reactions by which the "heat binding" substances employed are affected. Twelve claims are embraced in this patent, and the final claim, which is very comprehensive, is for "a method for actuating a thermo-dynamical machine by first binding the waste heat of the machine by dissolving solid substances in the vapors or their products of condensation to form a liquid, and then desiccating the liquid at a high temperature to recover the solid substance and the vapor containing the waste heat and the additional new heat of a high temperature introduced by the desiccation to form power to drive the machine."

Railway Appliances.

CAR COUPLING.—Charles E. Seabury, Stony Brook, N. Y. This is an improvement on a former patented invention of the same inventor providing means for automatically coupling cars, the improvement specially providing means for holding the coupling link in a perfectly straight position, so that it will be sure to enter the drawhead of an opposing coupling. For this purpose the drawhead is made with a concave recess in the top, and attached to the link is an upwardly curved spring to fit the recess. The spring also allows the link to be moved to one side or the other or to be moved vertically, so that it may be made to enter a higher or lower drawhead.

CAR BODY.—John Turner, New York City. This invention covers a novel construction, especially adapted for horse, cable, and electric cars, and designed to give greater air space and more head room than is usual in the cars at present in use, while the car will not be higher, will be very strong, and can be built at the minimum cost. The construction also provides for the perfect ventilation of the car, and the arrangement is such that the ventilating apparatus may remain open in inclement weather without admitting rain or snow to the interior of the car.

SIGNALING DEVICE. — William Newcomb, Johnsonville, N. Y. A semaphore blade attachable at different points on a pivotally supported sectional hub has interior springs to counterbalance the weight of the blade, and is arranged for operation in connection with batteries and circuit wires and devices on a locomotive and at stations to set signals automatically by the action of electricity and gravity, to protect the moving train in front and rear. The mechanism is so constructed that a visual signal is exposed which may also be seen in the dark, thus protecting the train by night as well as in the daytime.

RAILWAY. — William S. Herrington, San Francisco, Cal. This invention provides for a construction especially designed for use in cities, in which the track is underground while the body of the car is above ground. A tunnel of uprights, bases, ties and braces, is constructed just below the pavement, and the casing of this tunnel is formed with a continuous central slot at the top, widened at curves, the trucks riding on their wheels on the tracks laid in the base of the casing, having each an upwardly extending hollow extension supporting a disk with a hub, on which the car body is swiveled. The roadbed will thus be formed independent of ordinary roughness of the surface, the track will not interfere with travel and cannot be obstructed by snow, and the danger from runover accidents is greatly reduced.

CAR AND BRAKE FOR LOGGING RAILWAYS.—John N. Valley, Jersey City, N. J. Two patents have been granted this inventor, in addition to one for a logging railway heretofore granted the same inventor, the construction of the road, carriages and brake being also applicable for general use in transporting passenger cars, freight, etc., in situations where a quickly made and inexpensive structure is called for. The railway structure is elevated, and consists of a longitudinal log stringer supported by laterally diverging posts hangers from the stringer supporting the track. The frame of the carriage is U-shape, its upwardly ranging sides or legs carrying the car wheels to ride on each side of the suspended track. From the bottom of the carriage depend hooks for supporting the load. The drawbar is bolted to the yokes forming the carriage frame, and extends beyond both ends, forming buffers, several cars being thus conveniently coupled together. The brake for this carriage is of novel form, and the brake shoes, instead of being applied to the wheels, are adapted to be brought to bear with great force against the sides and bottom of the track, giving a power of braking that is especially desirable in mountainous regions where steep grades are frequent. The brake is of simple and strong construction, and the brake lever is in convenient reach of the car or train operator.

Mechanical Appliances.

TOOTHED GEARING. — Matthew P. Campbell, Glasgow, Scotland. This invention provides a wheel having angular pivoted teeth with enlarged roots adapted to bear against each other, the teeth being free to oscillate on their pivots, the distance of the teeth from center to center being constant, while their inclination may be varied to accord with screws or worms of varying pitch. The pivot pins may be passed through a row of holes in a circle around the wheel rim, or two rows of staggered holes may be formed in the rim, alternate teeth being pivoted in the outer circle of holes and the others in the inner circle. This gearing is especially adapted for the transmission of great power, and is particularly designed for use on wormwheels and worms.

MACHINE WRENCH.—Marshall Martin, Walla Walla, Washington. This is a combination wrench and bolt holder, in which the cog die and its toothed driving gear and shaft are contained in a housing composed of separate plates hinged together, and united by a fastening adapted to admit of the housing being opened as required. The device is especially adapted for use on the rims of vehicle wheels, to hold and fasten the screw bolts and nuts which assist in securing the tires on the wheels, and for unscrewing the bolts when required to remove the tire.

SANDPAPERING MACHINE. — Herbert Spoor, Berlin, Wis. In this machine the sandpaper is secured about the face of a horizontal cylinder, and the material to be operated upon is fed over the cylinder by means of feeding rollers, the invention providing for the uniform adjustment of the cylinder and of the feed rollers, while a reciprocating as well as a rotating motion is imparted to the sandpaper cylinder. The construction of the machine is such as to facilitate the ready adjustment of its several parts to the work in hand, and insure the regular feed of the material operated upon.

AX HANDLE FASTENER. — Joseph M. Didero, Lorain, Ohio. The end of the handle adapted to enter the eye of the blade has a transverse central slot crossed by a longitudinal slot. A wedge having a head fits in the central slot, and side wedges are introduced into the longitudinal slot, one at each side of the central wedge, the side wedges having heads with one side rabbeted on the under surface to adapt them to fit over the head of the central wedge. As an additional security, each of the side wedges has an aperture adapted to register with corresponding apertures in the blade at each side of the eye, and when the handle and wedges are in proper position a screw or bolt is passed through the registering apertures and through the handle.

NIPPLE HOLDER.—Henry B. Spencer, Catskill, N. Y. This device consists of a hollow body having one end internally screw-threaded and a plug adjacent to the threaded portion through which extends a squared hole, there being mounted in the threaded portion of the body a tapering head with cutting edges and having a shank extending through the hole in the plug, while a screw mechanism moves the shank and head. This improvement forms a simple and convenient device to efficiently hold the nipple while a thread is being cut on it.

CHUCK JAW. — William J. C. Rowe, New York City. This invention relates to extension jaws for chucks, providing a simple, economical and durable device stepped to receive articles of different diameters and capable of being readily attached to the jaws of any chuck to increase its capacity. For this purpose reversible auxiliary jaws are employed, which, when turned upon one face, will receive large objects, and when turned upon the opposite face, will clamp small articles. The auxiliary jaw may be a casting or a forging with central opening to receive and neatly fit the chuck jaws forming a portion of the ordinary chuck, the slotted portion being flat and smooth and adapted to fit closely to the face of the chuck.

CONCENTRATOR AND AMALGAMATOR.—Jacob Rodermond, New York City. Combined with a receiving pan having horizontal rotating arms and teeth on their lower faces, with perforated upright blades on their upper faces, a bottomless cup encircling their central portion, is a lower pan containing mercury, an apertured disk being in the pan and perforated plates attached to its upper face, while combined agitating and gathering devices are secured to its lower face. These devices consist of a horizontal body from which depends a spiral blade having its ends laterally curved in opposite directions, while there is a tubular connection between the upper portion of the upper pan and the lower portion of the lower pan, the improvement being designed to afford a simple and durable machine for treating ores, in which any number of pans may be employed.

Miscellaneous.

ANNUNCIATOR. — William C. Dillman, Brooklyn, N. Y. A swinging leaf carrying a mouth piece is arranged at the mouth of a speaking tube, a catch holding the leaf in raised position, while electrically operated means are employed for releasing the catch, and an electric bell is arranged in a circuit which is closed by the dropping of the leaf. When speaking tubes from several points all center at a common point, this improvement enables a speaker in a distant room to indicate positively at the central point the tube through which he is calling, as the leaf carrying its mouthpiece will be dropped and a bell rung by pressure on a push button, the bell continuing to ring until the leaf is again thrown up.

WASHING SUGAR.—Ramon F. Cordero, Rubio, Venezuela. This invention relates to the washing of sugar by alcohol, providing therefor a special form of apparatus whereby the same alcohol may be retained and used to wash successive charges. Combined with the sugar-receiving cone is an alcohol supply receptacle having a valved connection with the upper end of the cone, an outlet at the lower end of which has a glass section, below which and connected therewith is a boiler. There is an alcohol-condensing apparatus above the boiler, a trapped vapor pipe leading from the boiler to the condenser, and a valved pipe connecting the latter with the alcohol supply receptacle. The operation of washing the sugar and condensing the alcohol may be kept up in rapid succession, while one charge is being washed the alcohol of the preceding charge being separated from the molasses.

FABRIC TURFING TOOL. — Vicente Fernandez, Guanajuato, Mexico. This is an embroidering implement that may be readily carried in the pocket and used on a great variety of work. Its handle carries a hollow sleeve, and a spring-pressed rod having one end formed into a sleeve is adapted to slide in the handle sleeve, the opposite end being slotted and bent to form a presser foot. A rod extends through the handle sleeve to one end of which a needle is attached so as to project through the presser foot, the position of which is regulated by a brake. The tool is easily threaded, and may be readily changed to carry a great variety of thread, and it may be conveniently operated by a single hand.

HORSE DETACHER AND BRAKE.—Annie H. Chilton, Baltimore, Md. Arranged to slip on the ends of the shafts are cuff-like sections, to which are connected the traces, the singletree, and locking arms to hold the traces in place, the arms being connected with a spring-actuated locking device, by operating which the cuff-like sections may be pulled off the shafts. The invention also provides effective means whereby, when the horse is released from the vehicle, the shafts will be held up from the ground and the vehicle will be braked, thus avoiding the danger of an upset or of the breaking of the shafts after the horse is released.

INCUBATOR.—Archer H. Burr, Omaha, Neb. A double-walled case holds the egg trays, above which are located double tanks with their upper compartments open, an outside double tank provided with means for heating being connected with the inside tanks. The invention is an improvement in that class of incubators adapted for automatically supplying the egg chamber with the right amount of moisture and air, maintaining an even temperature therein if sufficient heat is supplied to the heating tank.

TYPE WRITING MACHINE.—Eugene A. Ford, New York city. This typewriter is designed to print a large number of characters or letters without the necessity of multiplying keys, while the ink ribbon is automatically moved to unwind from the full reel and wind upon the empty one. The finger key is specially adapted to rapid work, being so formed as to allow the finger to readily slip from its edge after the key is depressed. A series of tubular type arms in the machine carry spindles having on their free ends heads with different type and different sides, and on the opposite ends segmental pinions engaged by a circular rack in any position in which they may be placed, a locking and releasing mechanism controlling the rack, which is moved by a double-acting key and a series of levers.

DOOR TRACK AND HANGER.—Charles O. Parsons, Milwaukee, Wis. The door track is, according to this invention, supported from the studding of a partition wall by end brackets, and intermediate brackets, there being preferably three of the latter, one at the center and one at each side of the doorway or frame. Adjusting screws are provided to elevate or lower either end of the track to compensate for any settling of the building, and cause the doors to hang plumb at all times, and this can be done without the aid of a mechanic, as the adjusting devices are within easy reach without removing parts of the door frame or partition. The improvement is specially designed for use in connection with division doors of living rooms.

TRUSS.—George V. House, Jr., New York City. This invention provides a truss having improved means for altering the size, form, and relative position of the pad, to adapt it for service in all varieties of hernia. This truss has a pad bulb, made of partly elastic material, such as India rubber, etc., adjustable by means of a pivotal shank, entering a carrier plate after passing through a slotted base plate, and engaged by a binding screw passing through one of a series of holes arranged in rows radiating from the pivot shank in a cap plate and in the truss band between the cap plate and base plate.

TRUSS PAD.—An additional patent has been granted the above inventor for an improvement, whereby the production is cheapened and a more convenient, lighter device is afforded. In such cheaper grades it is found that good results can be secured by using a rigid pad bulb and dispensing with the carrier plate, the bulb having on its inner face a nut in which works a threaded hub with fixed headed shank, the base plate having a slot enlarged at one end to permit the head to enter and admit the shank in the slot, the pad and base plate being adapted for disconnection without removing the hub shank, and the position of the pad being readily adjustable.

LAMP EXTINGUISHER.—John B. Greenhalgh, Blackstone, Mass. This is a simple attachment designed to be readily applied to any ordinary lamp burner, by which the flame of the wick may be extinguished, and which will operate automatically to put out the light when the lamp is overturned. Two hoods having depending shanks are pivoted on the wick tube, a spring-pressed lever having a cup at one end and engaging the shanks by its other end, normally holding the hoods closed, while a weight resting in the cup of the lever holds the hoods open.

PUZZLE.—Elmer E. Jenne, Ilion, N. Y. This device consists of a closed receptacle containing a series of circular spaced ribs provided with non-aligning apertures, the cover having an inlet opening over a space inclosed by one of the ribs, and a second opening showing solid portions of the ribs. The puzzle is for the player or operator to so manipulate the board or receptacle that concealed balls may be made to travel from the innermost to the outermost circular space and back to the starting point.

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3229) F. & L. ask for some information in regard to staining cigar box lumber. A. Cigar box lumber is prepared by veneering. Whitewood is often used as the basis, veneered with Spanish cedar. On soaking a piece in water, the thin layer will come off.

(3230) E. C. A. writes: In our saw mill we are running a 54 inch circular saw at 700 revolutions per minute and another 34 inch saw at 1,200 revolutions per minute, which runs at a right angle with the big saw. The smaller saw is placed about 20 feet from the large one and about 8 feet to one side, and runs in the same direction. It has a ring of holes 9 inches from its center running all around the saw, and when in motion everything in the mill can be seen by looking through this ring of light as plain as looking through common window glass, and everything looks just as natural except the large circular saw, which appears to be revolving slowly backward, so slow that every tooth in the saw can be seen as plain as when standing still. When stopping the mill, the large saw appears to stop long before it really does. What is the cause of this strange delusion? A. The effect described is similar to that produced in the stroboscope or zoetrope. It is due to intermittent vision and the persistence of the retinal image. The rate of rotation of the small saw was related to that of the large saw in such a way as to permit of seeing the teeth of the latter only when the teeth were in certain positions, thus causing them to appear nearly stationary. The revolving saw viewed through an instantaneous photographic shutter would appear stationary. If viewed through a shutter opened and closed once during each revolution of the saw, the eye would receive a succession of images which would be retained by the persistence of vision and then blended into one continuous image. The small saw acted as a shutter in producing this effect. It is not necessary that the shutter should be limited to one exposure per revolution of the saw. There may be a number of exposures, but to make the saw appear stationary, the number should be an aliquot part of the number of teeth in the saw.

(3231) C. A. B. wishes the formula for the preparation of the platinum paper used by photographers. A. The sensitizing bath is made by dissolving dry ferric hydrate in a concentrated hot solution of oxalic acid. The acid is poured on to the ferric hydrate until it is just dissolved. Then 12 parts of sodium chloro-platinite are added to the hot solution. The whole is filtered and the solution thickened slightly by evaporation. The paper well sized is laid or floated

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on the sensitizing bath for five minutes, is then hung up to dry, and should be kept dry or in a vessel containing chloride of calcium placed in a false bottom. In printing one-third longer time is required than with silver paper. The print, which is only slightly discernible, is next dexterously floated on hot oxalate bath heated from 120° to 140° Fah. The developing oxalate bath is made as follows:

Oxalic acid	25 parts.
Sodium chloro-platinite	2 "
Water	250 "

The picture quickly develops out according as it has been printed. It is then washed in dilute hydrochloric acid and water baths and dried. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 711, page 11360.

(3232) J. M. writes: Do you think from a sanitary standpoint it would be proper to discharge the sewage of a hotel into a dry well, twenty feet deep, the bottom of which is loose, porous sand? The well will be 300 feet from the building. And if there would be any danger of contaminating the water of a spring 1,600 feet from the well and which runs from the base of a hill opposite to the one on whose side the well will be located? It is the intention to use disinfectants and deodorizers in the well; and do you think quicklime sufficient? A. From a sanitary standpoint it would not be proper to discharge the sewage into the well. The better way would be to make a tight cistern of cement in the ground to receive the sewage, the contents of the cistern to be periodically removed and spread on the ground at a distance from habitations. The well, if used as a receiver of sewage as you propose, would be likely to contaminate the spring and other waters near or distant, below the level of the bottom of the well. Quicklime would be a poor disinfectant.

(3233) J. C. S. & Co. — The work on the specimen of etched glass received was done by means of hydrofluoric acid, either in the form of liquid or vapor. The entire glass, with the exception of the portion to be etched, is covered with a protective coating of varnish or wax. If liquid hydrofluoric acid is used, the glass is either dipped into it or a wax lip may be built up all around the plate and the acid poured on. The etching requires 5 or 6 minutes. After the acid is poured off, the glass must be thoroughly washed with water. According to another method, powdered fluorspar is placed in a lead trough and sulphuric acid is poured over it. The glass is laid over the trough face down, and the etching is effected by the vapors. Great care is required in the use of this acid to avoid inhaling the vapors or allowing it to touch the skin.

(3234) T. H. W. asks: Is there a colorless wash or varnish that can be applied to a bright metal surface that will not easily rub off and prevent rust? A. Mastic or very thin white copal varnish may be used for bright work.

(3235) J. M. S. says: 1. Will you please tell me how an amateur can take photographs in colors? I have tried a mirror back of the plate, without success. Also if plates are manufactured for photography in colors, if so, where can I buy them? A. The Lipmann process of photographing in colors is only an experiment and is confined to the solar spectrum. No practical process has been formulated. Try Cramer's isochromatic plates, which reproduce the color values to better advantage. 2. Please give me a formula for making blue print paper that will keep for a long while? A. For a blue printing formula see SCIENTIFIC AMERICAN SUPPLEMENT, No. 584.

(3236) R. P. P. writes: Please find inclosed sample of cement taken from a thermometer used by packers of canned goods and upon steam boilers, which stands heat and pressure of about 300 degrees. It is used to form a steam tight joint between the thermometer tube and the brass casing. Will you be kind enough to inform a yearly subscriber of your paper how to make and use this cement, also if it will stand brine? A. The cement appears to be composed of plaster of Paris mixed with a solution of silicate of soda or soluble glass. You can obtain the silicate through the drug trade. It may be plaster of Paris mixed with strong solution of alum, or oxide of zinc mixed with a solution of chloride of zinc 10 to 20 per cent. Either cement is applied like plaster of Paris, and will stand brine reasonably well, especially the latter.

(3237) R. H. W. writes: I herewith inclose you a box of matches, just as it was opened, except two matches taken out. Will you kindly explain, through the columns of your journal, how every match in the box could be charred in this way, the phosphorus all burned, and no greater combustion. The wood part of the match seems to be merely discolored. The box containing them shows no mark of violence, and is not burned. These matches were packed 1 dozen boxes in a paper which was sealed up nearly air tight. A. The composition on the end of the matches probably contained phosphorus mixed with some compound rich in oxygen. If the package was closely sealed, the combustion would for want of air be confined to the ends of the matches if these became ignited. Moisture, if present, would be of great effect in reducing the intensity of the combustion, and might by itself suffice to confine it to the tips. How the ignition occurred can only be a matter of surmise.

(3238) O. McK. writes: 1. I want to make a dynamo from which wires run to the motor which drives the machine. If you have a SUPPLEMENT telling how to make such a dynamo, please say what number it is. A. SUPPLEMENT No. 600 contains full information on the construction of an 8 light dynamo. 2. What is a laminated armature? A. A laminated armature is one in which the core is formed of thin iron plates separated by insulation. 3. What candle power lamp would this run? A. The dynamo above referred to runs eight 16 candle power lamps. 4. Does distance between dynamo and motor have any effect on the speed? A. The distance makes a great difference if not compensated for by an increased cross section of conductor. If the resistance is kept down, the distance is immaterial.

(3239) C. G. A. asks: Can you give me any preparation for softening the wings of butterflies and moths, after they have become brittle? Can you tell me of something that will take parasites off worms without killing them, and keep large beetles from becoming odorous? A. The wings of butterflies are softened by placing the insect on a piece of hot clean paper laid on wet sand contained in a jar. In the course of 2 to 5 hours the wings are sufficiently soft to permit of spreading the same. Parasites can be taken off caterpillars by means of a fine pair of pliers, but the results are usually not very satisfactory. Large beetles are best opened on the tail or belly and the inner organs removed to avoid rapid decay and smell. (See SUPPLEMENT catalogue.)

(3240) H. G. wants a formula for albumenizing and silvering paper for photographic printing, one that will make paper which will keep for some time if possible. A. You can purchase albumenized paper with less expense than will be required to make it. To sensitize albumenized paper that will keep for some time, prepare a nitrate of silver solution by dissolving sixty grains of silver to the ounce and do not let it get lower than 50 grains to the ounce, testing occasionally with the hydrometer. After solution of the silver, add citric acid drop by drop, until the slight precipitate of citrate of silver formed is just redissolved. Float the paper on the bath from three to five minutes, and on removing, place between sheets of clean blotting paper, which may be used over again. Paper thus prepared has been kept white and good for nine months and tones easily.

(3241) G. G. writes: I wish to ask if you know of any substance to cover large nickel plated wrought and cast iron work to stop corrosion during transmission to South American ports. From experience I know that brass instruments covered with lacquer, notwithstanding being carefully packed, turn black and have to be shipped in air tight tin boxes. A. A good protection for nickel plated goods for export is paraffin applied hot, and the goods then wrapped in paraffin or wax paper. Waxed paper bags make an excellent waterproof and air tight package.

(3242) T. B. asks for a formula for toning wood prints black, or the color of prints on albumen paper. A. Tone with a bath made of—

Chloride of gold	1 gr.
Pulverized borax	60 "
Water	4 oz.

See page 225 of SCIENTIFIC AMERICAN, April 13, 1889.

(3243) J. A. R. says: Please give me a good formula for making a preparation which will kill the bed bug and destroy its eggs. A. Use corrosive sublimate, to be had at drug stores. Druggist will tell you how to use it.

(3244) T. D. McC. writes: In your answer to query No. 3180, I notice what looks like a slight error. You say, "If you divide the voltage by the number of watts, you will have the current in amperes required." As W = C E, dividing the number of watts by the voltage will give the required current, which is 0·845 ampere. The resistance of motor should be 130 ohms.

(3245) D. McC. S. S. writes: 1. I notice in this week's issue of your valuable paper, you state in answer to query 3152, "What is the difference between a square foot and a foot square? A. There is no difference in area or quantity of surface, but there may be a great difference in shape," etc. Now it seems to me that though this answer is, when applied to one square foot, perfectly correct, it would be liable to be misleading when applied to more than one. Thus, for instance two feet square would be equal to $2^2 = 4$ square feet, and I therefore think that the number of square feet in a given area of feet square would be best expressed by the formula x F. sq. $= x^2$ sq. F. Please inform me whether this is not correct. A. This is right as far as it goes, but your formula only applies to squares, and does not take rectangular figures within its scope. 2. Also, could you inform me what is the value of ordinary carrier pigeons in this country, and would these be capable of carrying small packages of say 4 to 8 oz., or can they only carry very light letters? A. Carrier pigeons can only carry light letters. Their price varies with their age, breeding, and proved abilities. 3. Also what is the world's total output per annum of platinum, and what is the present and what the average price of such? A. We have no very recent figures. In 1887, the production of platinum in Russia was placed at 113,724 troy ounces; 2,000 or 3,000 ounces additional were produced elsewhere.

(3246) B. M. I. asks: 1. How is wood made into pulp, and how is wood pulp converted into paper? etc. A. For wood pulp we refer you to our SUPPLEMENT, Nos. 293, 299, 311, and 570. 2. What is "Frankford black" and how is it made? A. It is a kind of black, said to be made by burning grapevine twigs or cuttings, used in printer's ink.

(3247) H. H. W. asks: 1. What is the chemical formula for aurate of ammonium? A. It is of indefinite composition. A typical formula would be $Au_2O_4(NH_4)_2.3H_2O$. 2. How is it manufactured? A. By precipitating a solution of gold with ammonium hydrate and boiling in an excess of the same; or by digesting auric hydrate in a solution of ammonium sulphate. 3. What is its explosive power compared to nitroglycerine? A. Probably ⅛ that of nitroglycerine. 4. What is the highest explosive known? A. Of the commercial explosives, nitroglycerine. 5. Can fulminate of silver or mercury be exploded without drying or removing from the liquids from which it is produced? A. Safety is secured by keeping them immersed in water, yet explosion while so immersed is at least a possibility. 6. Will nitric acid and glycerine produce enough heat on uniting to explode itself? A. No.

(3248) L. M. asks: 1. I have some specimens of satin spar that have been cut into gems for setting. They are beautiful, but are very soft. Is there any way of hardening them, also can they be colored, and how? A. They cannot be hardened nor satisfactorily dyed. 2. What way is there of preserving natural colors, in dried and pressed flowers, etc.? A. Only by avoiding exposure to light. 3. I have specimens of quartz, clear and white crystals, etc., that have been naturally stained red and yellow by sulphur, iron and alum. What chemicals or receipt can I use that will clean them and remove the stains without injuring the specimens? A. You can boil in strong hydrochloric or sulphuric acid without effect on the quartz. 4. Where can I buy agate and jasper in the rough, in vicinity, and price per lb., also Mexican onyx that is used in New York, and any other semi-precious stones for ornamental and fancy work, in rough and polished? A. Address Tiffany & Co., or Eimer & Amend, of this city.

(3249) J. R. N. asks: What is the metal gallium? Where found? What are its uses? And how long has it been known? A. Gallium is an exceedingly rare metal, and hitherto only a chemical curiosity. It is found in zinc blende from the Pyrenees and other localities. It was found in 1875, by Boisbaudran.

(3250) G. A. D. asks: 1. What is an alum cell? What is an iodine cell, and how can I construct them? The above are mentioned in "Experimental Science," on page 189, under radiometer. A. An alum cell is a tank with plate glass sides filled with a strong solution of alum. It stops most of the heat rays while allowing the light rays to pass. For use in an ordinary lantern, the cell should be ¾ inch thick. An iodine cell may be made with glass sides, but rock salt is used when perfect results are required. The cell should be 2 inches thick. The solution is made by dissolving iodine in bisulphide of carbon. The solution should be a saturated one. This cell stops the light rays and allows the heat to pass. 2. Also a selenium cell, and how can it be made? A. Selenium is rubbed on a heated brass grating; the heat melts the selenium, and some of it enters the spaces in the grating. When the selenium has cooled and crystallized, the cell is ready for use. You will find a full description of the photophone in "The Telephone," by G. B. Prescott. 3. Is it possible to reduce the resistance in a vacuum tube for the passage of the electric current to an equivalent of, let us say, the resistance of dilute sulphuric acid? A. It would be impossible to reduce the resistance to that extent. The resistance of an ordinary vacuum tube is about as small as it can be. 4. How much are five degrees Fahrenheit expressed in heat units? A. A heat unit is the amount required to raise the temperature of one pound of cold water one degree Centigrade. The Centigrade scale can be converted into Fahrenheit according to the following formula:

$$\frac{\text{Centigrade} \times 9}{5} + 32 = \text{Fahrenheit.}$$

5. Where could I buy an air pump (piston pump) of good reliable make which would not be too expensive? A. You can buy air pumps from any of the dealers who advertise in our columns.

(3251) C. A. H. asks: In rewinding a small electric motor, say about one-eighth horse power, to adapt it to Edison 110 volt circuit, what should the resistance be in the fields and armature, and the best way to connect up shunt or series? A. The resistance of the machine should be such as to use the amount of current required for the power needed. An electrical horse power is 746 watts. A watt is one ampere multiplied into a volt. If you require one-eighth horse power, you will need about 93 watts. Your E. M. F. is 110 volts; therefore, if you divide the number of watts by the voltage, you will have the current in amperes required, which is 0·84 ampere. Now, to arrive at the total resistance of the machine, you will divide the voltage by the amperage, which will give you 130 ohms. Of this amount, if the machine is series wound, the resistance of the field magnet should be about one-half that of the armature, while if it is shunt wound, the resistance of the field magnet should be about fourteen times that of the armature.

(3252) F. H. B. writes: I have been rewinding a small motor for 110 volts, and about the same time you answer question number (3180) C. A. H. I have been questioning its correctness in my own mind and would like to ask you if am not correct and your answer is wrong; 746 watts divided by ⅛ gives 93 watts required. Now, you say divide the voltage by the number of watts and gives 1·18 amperes; but I think to divide the watts by the voltage is correct, which gives 0·84 + ampere. Now divide the voltage by amperes and it gives 130·8 + ohms resistance of wire, instead of 92 ohms. I think this way is correct, because watt is voltage multiplied by amperes. Now, having the watts and voltage, the ampere must be the number of times the voltage is into the watts, instead of watts into voltage, as you state in that answer. A. You are correct in your conclusions in regard to determining the amperage and resistance of the motor. The reply referred to was erroneous, the same is corrected in this number of the paper.

TO INVENTORS.

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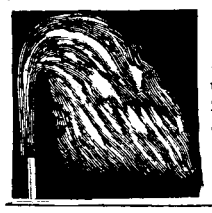

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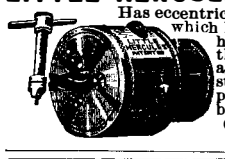

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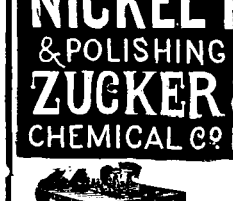

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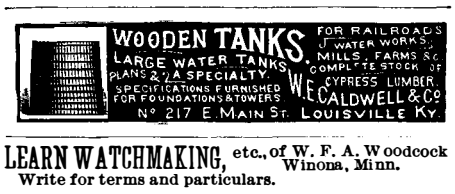
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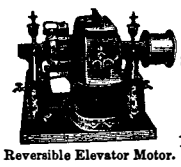

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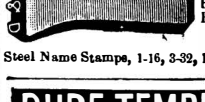

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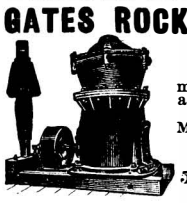

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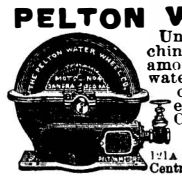

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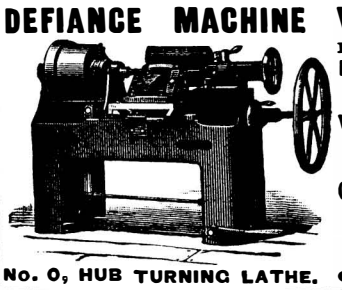

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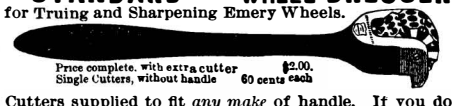

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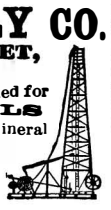

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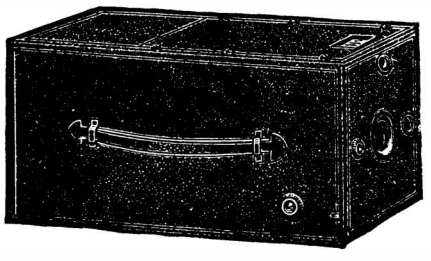

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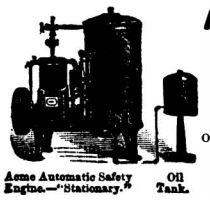

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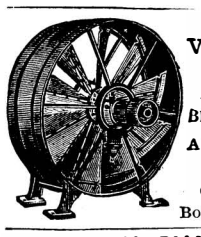

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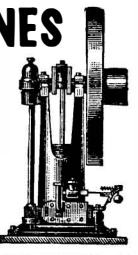

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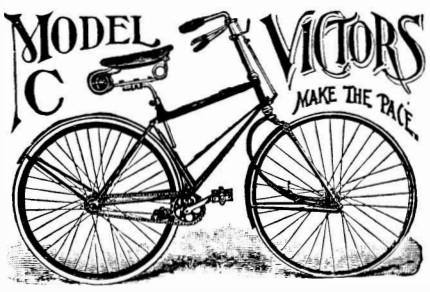

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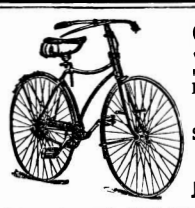

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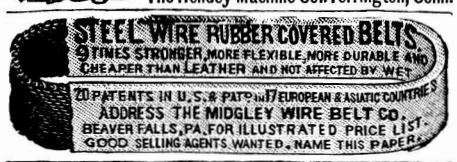
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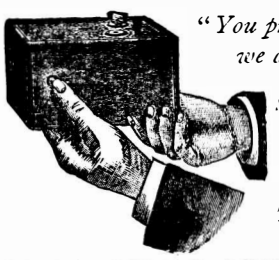

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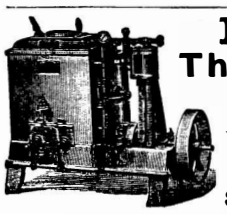

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